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REMARKS

ON THE PRESENT

SYSTEM OF ROAD MAKING;

WITH OBSERVATIONS,

DEDUCED FROM PRACTICE AND EXPERIENCE,

WITH A VIEW TO A REVISION OF THE EXISTING LAWS,
AND THE INTRODUCTION OF IMPROVEMENT IN

THE METHOD OF MAKING, REPAIRING,
AND PRESERVING ROADS,

AND

DEFENDING THE ROAD FUNDS FROM MISAPPLICATION.

FIFTH EDITION,

CAREFULLY REVISED, WITH CONSIDERABLE ADDITIONS,

AND AN

APPENDIX.

BY JOHN LOUDON M^cADAM, ESQ.
GENERAL SURVEYOR OF THE ROADS IN THE
BRISTOL DISTRICT.

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TO THE GENERAL TREASURER, THE TREASURERS OF DIVISIONS, AND THE OTHER COMMISSIONERS FOR THE CARE OF THE TURNPIKE ROADS IN THE BRISTOL DISTRICT, TO WHOSE FIRMNESS AND PATRIOTIC ZEAL IN THE DISCHARGE OF THEIR DUTY, THE KINGDOM IS INDEBTED FOR THE FIRST EXAMPLE OF THE PRACTICE OF A NEW AND EFFECTUAL SYSTEM OF IMPROVEMENT IN THE REPAIR OF THE ROADS, AND IN THE ADMINISTRATION OF THE FUNDS UNDER THEIR CARE; **THESE REMARKS** ARE MOST RESPECTFULLY DEDICATED, AS A TESTIMONY OF THE ESTEEM AND GRATITUDE OF THEIR

OBLIGED AND OBEDIENT SERVANT,

THE AUTHOR.

INTRODUCTION.

THE present very defective state of the Turnpike Roads and Highways in the United Kingdom, and the continual and apparently unlimited increase of the Toll Duties, are the considerations, which have given rise to the publication of the following remarks.

Of the value of the information contained in them, the intelligent reader will be the most competent judge; the author can only venture to assure him, that the few facts brought forward in the course of the work have been most carefully authenticated; that the opinions advanced are the result of much thought, and patient investigation; that whatever may appear theoretical, has, for the most part, been already reduced to practice; and that where practice has been wanting, a long experience of the evils arising from the present system, and

not the mere love of innovation, has been the motive for the suggestion of the remedies proposed.

These, however, the author gladly submits to the good sense and candour of the public; only requesting, in the words of a celebrated writer, that whoever favors him with a perusal, will not judge by a few hours reading of the labours of nearly thirty years.

In the following chapters, the subject of Roads will be considered under three principal heads:

THE MODE OF MAKING ROADS;

THE COMMISSIONERS, AND OFFICERS EMPLOYED UNDER THEM, FOR THIS SERVICE, and

THE CARE OF THE FINANCES:

Which has appeared to the Author the most clear and comprehensive arrangement.

REMARKS ON ROADS.

PART FIRST.

THE MODE OF MAKING ROADS.

THE modes of making and repairing Roads are so various in the different parts of the kingdom, that it would be an endless task to attempt a particular account of each. It may, however, be possible to give a general idea of them, according to the materials produced in each part of the country.

In the neighbourhood of London, the roads are formed of gravel; in Essex and Sussex, they are formed of flint; in Wilts, Somerset, and Glocester, limestone is principally used; in the North of England, and in Scotland, whinstone is the principal material; and in Shropshire and Staffordshire, large pebbles mixed with sand.

Excellent roads may be made with any of these materials.

The gravel of which the roads round London are formed is the worst; because it is mixed with a large portion of clay, and because the component parts of gravel are round, and want the angular points of contact, by which broken stone unites, and forms a solid body; the loose state of the roads near London, is a consequence of this quality in the material, and of the entire neglect, or ignorance of the method of amending it.

A more careful examination of facts connected with the roads round London, has discovered several other causes, from whence proceeds the defective state of these roads. The greatest appears to be, the division of the roads into so many small Trusts, which precludes the possibility of any extended plan of operations, for the benefit of the whole. Before any one road round London can be properly reformed, and all wasteful expenditure restrained, a comprehensive view of the local situation of the whole district will be requisite.

Another great impediment to improvement, arises from the laws and regulations, which prevent a supply of good road materials, of several kinds, being brought to London by water, and landed in different places, convenient for the roads. Were these restrictions re-

moved, as far as concerns stone, flint, or any ballast for road-making, London is so favorably situated for water-carriage by the river, and by the canals connected with it, that a supply, equal to the wants of all the roads in the vicinity of London, might be obtained at a reasonable rate, and of good quality, so as to render the use of the bad gravel round the metropolis no longer necessary.* But this measure, to be performed in an economical, and efficient manner, must be done upon an extended scale; it must become one interest, directed by one select body of men of weight, ability, and character.

A road near London may be made as smooth, solid, and easy for cattle to draw carriages over, as the road near Bristol; and the London road *so made* will last longer, and consequently be less expensive than the Bristol road, because the materials which may be obtained are more durable, and may be procured at less expence.

* This must not be understood as conveying an opinion, that a good road may not be constructed with the London gravel, properly prepared and applied. The road at Reading, in Berkshire, has lately been made perfectly smooth, solid, and level, with a gravel inferior to that of London, and at less than it formerly cost. Carriages make no impression on this road, and it has remained good in all changes of weather. Nevertheless, a means having been discovered, by diligent enquiry, for importing flints, from a distance, the Reading road will, in future, be repaired with flint, at half the expence required to prepare the gravel of the neighbourhood.

Flint makes an excellent road, if due attention be paid to the size; but from want of that attention, many of the flint roads are rough, loose, and expensive.

Limestone, when properly prepared and applied, makes a smooth, solid road, and becomes consolidated sooner than any other material; but from its nature is not the most lasting.

Whinstone is the most durable of all materials; and wherever it is well and judiciously applied, the roads are comparatively good and cheap.

The pebbles of Shropshire and Staffordshire, are of a hard substance, and only require a prudent application to be made good road materials.

On the other hand, the Scottish roads, made of the very best materials, which are abundant and cheap in every part of that country, are the most loose, rough, and expensive roads in the United Kingdom, owing to the unskilful use of the material.

The *formation* of roads is defective in most parts of the country; in particular the roads round London, are made high in the middle, in the form of a roof, by which means a carriage goes upon a dangerous slope, unless kept on the very centre of the road.

These roads are repaired by throwing a large quantity of unprepared gravel in the middle, and trusting that, by its never consolidating, it will in due time move towards the sides.

When a road has been originally well made, it will be easily repaired. Such a road can never become rough, or loose; though it will gradually wear thin and weak, in proportion to the use to which it is exposed; the amendment will then be made, by the addition of a quantity of materials prepared as at first. As there will be no expense on such road, between the first making and each subsequent repair, except the necessary attention to the water ways, and to accidental injuries, the funds will be no longer burdened with the unceasing expenditure, at present experienced, from continual efforts at repairing, without amendment of the roads.

There cannot be a doubt, that all the roads in the kingdom may be made smooth and solid, in an equal degree, and to continue so at all seasons of the year. Their durability will of course depend on the strength of the materials of which they may be composed, but they will all be good while they last, and the only question that can arise respecting the kind of materials, is one of time and expence, but never of the immediate condition of the roads.

The anxious provisions of the Legislature for *preservation* of the roads have unfortunately taken precedence of measures for making roads fit to be travelled upon, or worth the care of being preserved. Will it be deemed presumptuous to propose, that some regulations may be adopted, for encouraging and promoting a better system of making roads, by eliciting the exertion of science, and by creating a set of officers of skill, and reputation, to superintend this most essential branch of domestic economy?

When roads are properly made, very few regulations are necessary for their preservation. It is certainly useful to make effectual provision for keeping clear the water-courses, for removing nuisances, and for the pruning of trees and hedges; for these purposes ample powers should be given to Commissioners; but the advantage of many existing regulations respecting wheeled carriages may very well be questioned. There can be no doubt that many of those regulations are oppressive to commerce and agriculture, by compelling an inconvenient construction of carriages.* The author has

* The increase of the breadth of the wheels, though in a greater proportion than that of the weights, is by no means a compensation for it; because the whole breadth in many instances, from the inequality of the ground, or the wheels, will not be brought to bear; whenever it can, the

never observed any great difference of effect, on a *well made road,* by narrow or broad wheels; either of them will pass over a smooth, solid road, without leaving any visible impression: on rough, loose roads, the effect will certainly be different; but whether a loose and rough road can be amended by dragging an unweildy carriage over it, or whether, if it were possible to amend roads by such means, it can be deemed the most economical for the nation at large, can hardly be subject of doubt.†

It must however be admitted, that the *wear* of roads is proportioned to the weight and velocity of carriages running upon a given breadth of the tire of the wheels, and therefore, it is of

first impression must be made by the nails, where they are prominent, perhaps by a single nail; or the bearing may happen upon single pieces of materials, or upon the edges of materials, incapable of supporting the weights. *See Enquiry into the State of the Public Roads, by the Rev.* HENRY HOMER, *A. M. Rector of Birdlingbury, Warwickshire. Published in* 1767, *Page* 66.

It must be observed, that these remarks of Mr. Homer, and of every other writer on the subject of roads, are only applicable to such as are loose, rough, and uneven; and that no one seems to have contemplated the idea of a road being made at once strong, smooth, and solid.— AUTHOR.

† Broad-wheeled carriages are found to be so unadapted to the purposes of husbandry, the number of horses requisite for their draught so great, and the beneficial effects of them to the road so questionable, that neither the encouragements on the one hand, nor the discouragements on the other, have been sufficient to bring them into general use.

HOMER'S ENQUIRY, Page 25.

consequence that some regulations should be adopted. The best regulations, as regard the breadth of the tire of wheels, will be found in several Acts of the Session of Parliament 1816, where Carts are required to have wheels of a cylindrical form five inches broad; and Waggon Wheels of the same form six inches broad, with an equal upright bearing. The weights will be best and most easily regulated by the number of horses, or other cattle, drawing the carriages: and this, as a regulation of economy, may be made, by the tolls at present payable on the cattle being levied in a larger ratio as the number increases.

Waggons and carts with wheels of a cylindrical form and upright bearing, running on a breadth of tire of five and six inches, cannot injure a well made road, at the slow pace with which such carriages travel; at least, in any proportion beyond the toll they pay. On the contrary, it is certain, that Stage Coaches, with their present system of loading, and velocity of travelling upon very narrow wheels, damage the roads in a much greater proportion than the compensation derived from the toll.

Every wheel, propelled by a force applied to its centre of motion, as the axis of a carriage wheel, is disposed by its specific gravity, to be

dragged forwards, instead of turning round; and the rotative motion is occasioned by the resistance presented by the surface over which it passes; yet this resistance does not entirely prevent dragging; for every wheel running upon a road drags in some degree. This degree will be proportioned to the weight of the carriage, and the velocity of the wheel upon its axis, and will be opposed by the breadth of the tire coming in contact with the road.

Stage Coaches, therefore, carrying heavy weights, moving with great velocity, and presenting to the road a narrow tire of wheel, must of necessity drag in a greater degree than any other carriage, as combining in themselves every cause by which dragging is produced.*

When the Legislature shall have provided the means of putting all the roads in the United Kingdom into the best and fittest state for the accommodation of the agriculture and commerce of the country, they will naturally consider of the most proper modes of protecting them from injury, or for indemnifying the

* Above fifty Stage Coach journies are made daily between Bristol and Bath: the Author's observation leads him to the conclusion, that the toll duty paid by them, does not indemnify the funds for the wearing of the road.

funds for the effects of use which are unavoidable, by imposing toll duties in a just and equitable proportion on the carriages occasioning such injury.

PART SECOND.

COMMISSIONERS AND OFFICERS EMPLOYED UNDER THEM.

THE care of the Turnpike Roads has been committed by Parliament, into the hands of Commissioners, selected from that class of society, most capable of executing the duties of superintendance, and from their station most likely to perform the duty with fidelity; in this respect the expectations of the public has not been disappointed; and there can be but one opinion, upon the obligations the country owes to this very respectable part of the community. Perhaps the only useful regulation wanted, in respect to Commissioners, would be to confine the qualification of Trustees to *landed* property.

The superintending and controuling power, so wisely placed by Parliament in the Commissioners, has not, however, been sufficient to

secure all the objects of the Legislature. A scientific, laborious, executive power is wanting; and no means having been thought of for this part of the service, it has been altogether neglected, or at best very unprofitably supplied by a set of Surveyors, altogether ignorant of the duties of the office they were called upon to fill.*

General superintendance and gratuitous services, such as the law contemplated to receive from the Commissioners of Turnpikes, may be obtained, and have been faithfully and conscientiously given by the Commissioners; but that constant and laborious attention, requisite to superintend the executive duties of a turnpike trust, cannot reasonably be expected from gentlemen engaged in other pursuits. Were they to undertake the task, it must be subject to all the interruptions of their private affairs, or other occupations; and this alone would render their services nugatory. Some instances of individual zeal and exertion, on the part of Commissioners, in particular parts of the country, have served to show what benefit might be

* The general laws relating to highways seem sufficiently calculated to answer the purpose intended by them, if Overseers were qualified with a sufficient degree of judgment to execute them properly, and of industry and spirit to do it effectually. HOMER'S ENQUIRY, Page 18.

derived from providing each county with an executive officer, whose sole attention should be given to the business; whose services should be amply remunerated, and of whom the Commissioners might *of right* demand an account of the manner in which their orders were carried into execution; who should examine and audit the accounts of the Sub-surveyors; compare them with the work performed, and certify them, if approved, to the Treasurers.

In a trust of any extent, say about 150 miles of road, the time of such an officer would be very fully employed. He must direct the execution of the repairs, and alterations of the road, when ordered by the Commissioners; and he must controul the contracts, and other agreements entered into by the Sub-surveyors, so as to prevent unnecessary expence; he must examine all work performed, to see that it is corresponding with contracts, and generally keep a vigilant superintendance over the persons employed under him. Accounts of all expences incurred should every second week be delivered by the Sub-surveyors into his office in duplicate; after examination, one copy to remain in the office, the other certified, to be sent to the Treasurer, upon which payment may follow.

Much must depend on the selection of the officer to whom this charge is committed; he must have a considerable share of general information respecting country business; the subject of road-making ought to have been well considered by him; his station in society should be such, as to secure to him the support and confidence of the Commissioners, while it commands the obedience and deference of the subordinate officers.

The success of the exertions of individual Commissioners, in particular parts of the country first suggested the opinion, that a better system of road-making might be adopted, and the examples of a better practice extended to all parts of the country; but the benefit can never be rendered thus general, unless accompanied by the zeal and activity that produced it; and this can only be supplied by officers, whose sole duty it shall be, and who will be accountable to the Commissioners under whose orders they act for the execution of the trust confided to them. Gratuitous services are ever temporary and local, they are dependant on the residence, and life of the party; and have always disappointed expectation. Skill and executive labour must be adequately paid for, if expected to be constantly and usefully ex-

erted; and if so exerted, the price is no consideration when compared with the advantage to the public.

From the want of such an officer, the orders of the Commissioners, after having been maturely considered, and wisely given, have fallen, for execution into the hands of Surveyors, selected not unfrequently from the lowest class of the community, who have proceeded without plan or method. The consequence is seen in every corner of the country; want of science in the Surveyor has gone hand in hand with improvident expenditure, to the injury of the roads, and the derangement of the finances. A vigilant and unremitting superintendance is wanting to ensure an economical and effectual execution.

Whether it may not be useful to empower Commissioners in the small Trusts into which the roads of England are unfortunately divided, to unite together in sufficient number to enable them to provide a respectable and efficient executive officer, and for other general purposes of improvement, is humbly submitted to the wisdom of Parliament.

The effect of an active and efficient controul over the Sub-surveyors, in the executive part of their duties; and in rescuing the funds from

misapplication and depredation, is exemplified in the measures wisely entered into by the Commissioners for the care of the turnpike roads in the BRISTOL DISTRICT, the success of which has amply justified their adoption, the roads having been entirely reformed and put into the best possible state for use, at an expence considerably within the revenue of the Trust. This improved state of the finances has enabled the Commissioners to effect several great permanent improvements, without forgetting the necessary provision for liquidation of the debt, which had accumulated during former years.

PART THIRD.

CARE OF THE FINANCES.

THE funds placed by the Legislature at the disposal of the Commissioners for the care of turnpike roads are very considerable, and might be supposed with proper management, fully equal to the object; they arise principally from toll duties, and a proportion of statute labour.

As long as it shall be necessary to raise large sums for the maintenance of roads, the present means must continue; toll duties, although liable to many objections, are so *immediately*, and *effectually* productive, that little hope can be entertained of the possibility of their being reduced, until a continuance of a better system shall have materially amended the roads, and reduced the expence, so as to leave means for extinguishing the heavy debt owing by the country for this branch of the public service.

Statute labour, in kind, was decreed by Parliament at a time, when no better means could be devised: when a circulating medium was deficient, and when a fair quantum of labour could not, in many parts of the country, be obtained for money.

Personal labour for a public service can never be made profitable, or fairly productive; at the same time, it is liable to the great objections of being made an instrument of partiality and oppression under the direction of a class of men with whom such a power should never be lodged, and over whom, in this instance, no adequate controul can be placed.

The causes, which operated to induce Parliament to resort to personal service, having ceased, it will be found expedient to commute statute labour for a moderate assessment in money. This has been effected with great advantage in Scotland, by most, if not all of the local and county Acts for turnpike roads.*

The sum of money annually raised in the kingdom for roads is very great, and would

* It is impossible not to see that statute labour is a remnant of personal service; a gentleman might as well argue at the present day, that rents paid in kind, are more easy and equitable than monied rents, as to defend the custom of mending highways by compulsory labour.

EDGEWORTH'S ESSAY ON THE CONSTRUCTION OF ROADS AND CARRIAGES, p. 46.

be found, if carefully examined into, much beyond the general belief. Government have procured information, as to the sum raised annually for *parish* roads (generally denominated highways) but they have not yet enquired into the amount of the much greater sum raised for the maintenance of the *turnpike* roads, nor into the amount of the debt incurred for the same purpose.

These funds, considerable as they are, continue to be expended, *nominally*, under the direction of Commissioners, but *effectually* and *practically* under the Surveyors, over whom the Commissioners have very uncertain means of useful controul; and there is no doubt, that much abuse exists in the expenditure, partly from ignorance, but much more from peculation and patronage very much misplaced.

Under such circumstances the protection of the funds would be promoted by the inspection and controul of a superior officer; and finally it might be desirable, that a report from each trust should be made to Parliament of the receipt and expenditure for the year.

That the funds provided by Parliament for the roads are either insufficient for the object, or that they are improvidently expended, is best proved by the numerous applications to

Parliament in every Session, for extension of powers and increase of tolls; setting forth that without such aid the debts cannot be paid, nor the roads kept in repair. In the Session of Parliament 1815, thirty-four such petitions were presented; and in the Session of 1816, thirty-two; all which bills were passed *as a matter of course;* the petitioners being only required to prove the *actual necessity* to the Committee, but no enquiry seems to have been made as to the *cause* of that necessity.

An efficient, uniform and constant controul of the expenditure of road funds, and an annual report of the result to Parliament would enable the House of Commons to form a judgment, whether the deficiency proceeded from inadequacy of the means, or from improvident expenditure; and thereby that Honourable House would be enabled to use means for preventing the growing amount of debt, which the petitions presented each Sessions sufficiently shew to be increasing to an alarming degree; and which, being incurred under the authority of Parliament, must ultimately become a claim upon the justice of the country.

Upon consideration of this important subject it appears, that a review of the turnpike laws has become indispensable, for the purpose of

altering and amending obsolete, useless, and oppressive regulations; and for substituting others more consonant with the present state of society. This review is required by experience of the inadequacy of the present system, to the great object of forming the best and easiest communications through every part of the country, with a due regard to economy; and for preventing the increase of a debt, which has been allowed, *in silence*, to accumulate to an extent, that will hardly be credited when properly and accurately ascertained.

Many and important improvements have originated from the good sense and zeal of individual Commissioners, or from particular district meetings, the good effects of which have been confined to the place of origin; such improvements have also ceased to operate, on the death or removal of their authors, and have been thereby finally lost, for want of a general superintendance, which would have an interest in the improvement of the whole.

The defective state of the roads, independant of the unnecessary expence, is oppressive on agriculture, commerce, and manufactures, by the increase of the price of transport, by waste of the labour of cattle, and wear of carriages, as well as by causing much delay of time.

Under an efficient and responsible executive department, established and directed by the wisdom of Parliament, this subject would be brought within the means of examination and regulation; and many local improvements, which have been confined to small districts, would be brought forward, and communicated generally for the public benefit.*

* Since this Essay was written, I have visited England, and have found, on a journey of many hundred miles, scarcely twenty miles of well-made road. In many parts of the country, and especially round London, the roads are in a shameful condition. This must strike the public; and sooner or later the good sense of the English nation will feel the necessity of adopting some means of improvement.

EDGEWORTH'S ESSAY, Preface, p. 7.

In Ireland, the cross-roads are generally better than the great roads, and comparing all the roads in that country with the roads in England, the shameful inferiority of the latter would evidently appear.

EDGEWORTH'S ESSAY, p. 46.

THE Author has abstained from any notice of the parish roads; although their condition and the state of their funds, are more deplorable than that of the turnpike roads. The Legislative enactments for their maintenance and repair are so inadequate to the object, that they may be considered as being placed almost out of the protection of the law.

There can be no apparent good reason, why, such a distinction should be made between the two description of roads; and their being both placed under the care of the Commissioners, with the benefit of the scientific direction of a General Surveyor, would ensure an equal improvement of the parish roads.

The foregoing Remarks on Roads cannot be better concluded than by the following Extract from the Report of the Committee of the House of Commons in 1811.

"The many important advantages to be derived from amending the highways and turnpike roads of the kingdom need hardly be dwelt upon. Every individual in it would thereby find his comforts materially increased, and his interest greatly promoted. By the improvement of our roads, every branch of our agricultural, commercial, and manufacturing industry would be materially benefited. Every article brought to market would be diminished in price; the number of horses would be so much reduced, that by these, and other retrenchments, the expence of FIVE MILLIONS would be annually saved to the public. The expence of repairing roads, and the wear and tear of carriages and horses, would be essentially diminished; and thousands of acres, the produce of which is now wasted in feeding unnecessary horses, would be devoted to the production of food for man. In short, the

public and private advantages, which would result from effecting that great object, the improvement of our highways and turnpike roads, are incalculable; though from their being spread over a wide surface, and available in various ways, such advantages will not be so apparent as those derived from other sources of improvement, of a more restricted and less general nature."

Appendix.

Extracts from Observations on the Highways of the Kingdom, by JOHN LOUDON M'ADAM, *presented to a Committee of the House of Commons, and printed by order of the House,* 14*th June* 1811.

"In all the Reports of Committees of the "House of Commons on the subject of Roads, "they seem to have had principally in view the "construction of wheeled carriages, the weights "they were to draw, and the breadth and form "of their wheels; the nature of the roads on "which these carriages were to travel has not "been so well attended to."

"The observations I have made in a period "of twenty-six years on the roads of the king-"dom, in which time I have travelled over the "greater number in England and Scotland, and "the opportunities I have had of making com-"parisons on the different materials and the "modes of their application, have led me to "form the following conclusions."

" 1st. That the present bad condition of the " roads of the kingdom is owing to the injudi- " cious application of the materials with which " they are repaired, and to the defective form of " the roads."

" 2nd. That the introduction of a better sys- " tem of making the *surface* of roads, and the " application of scientific principles, which has " hitherto never been thought of, would remedy " the evil."

" In illustration of these positions, I beg to " observe, that the object to be attained in a " good road, as far as regards the surface, is to " have it smooth, solid, and so flat as that a car- " riage may stand upright; these objects are " not attained by the present system, because " no scientific principles are applied; but it is " presumed they are perfectly attainable in all " parts of the country."

" Stone is to be procured in some form in al- " most every part of the kingdom, and a road " made of small broken stone to the depth of " ten inches, will be smooth, solid and durable."

" The materials of which the present roads " are composed, are not worn out; but are dis- " placed by the action of the wheels of car- " riages upon stones of too large a size: the " wheel does not *pass over* the materials of

"which the road is formed, but is constantly,
"almost at every step, encountering an obstacle
"which must either give way and be removed,
"or the carriage must be lifted by the force of
"the cattle so as to surmount it; in either case
"the road is injured, and the carriage impeded,
"and the injury and impediment will be great
"in the exact proportion to the number and size
"of the obstacles."

"The size of stones for a road has been de-
"scribed in contracts in several different ways,
"sometimes as the size of a hen's egg, some-
"times at half a pound weight. These descrip-
"tions are very vague, the first being an indefi-
"nite size, and the latter depending on the den-
"sity of the stone used, and *neither* being at-
"tended to in the execution. The size of stone
"used on a road must be in due proportion to
"the space occupied by a wheel of ordinary di-
"mensions on a smooth level surface, this point
"of contact will be found to be, longitudinally
"about an inch, and every piece of stone put
"into a road, which exceeds an inch in any of
"its dimensions, is mischievous."

"The roads in Scotland are worse than those
"in England, although materials are more
"abundant, of better quality, and labour at
"*least* as cheap, and the toll duties are nearly

" double; this is because road-making, that is
" the surface, is even worse understood in Scot-
" land than in England. By a late discussion
" in Parliament on the subject of Mail Coaches
" paying toll, it was universally allowed that
" the roads in Scotland were in a deplorable
" state, and in their circumstances, bankrupt."

NOTE.—*It is understood, that the Postmaster-General was obliged to give up the mail-coach from Glasgow to Ayr, on the road towards Ireland, on account of the expence of tolls, and the bad condition of the road; there being ten turnpike gates on thirty-four miles of road.*

DURING nearly five years that the writer has given his whole attention to the improvement of the Turnpike Roads, experience having confirmed his ideas on the subject, no endeavours have been spared, to extend the benefits which have already resulted to the Bristol district, over the whole country. The very limited means possessed by any individual for influencing this important branch of domestic economy, has occasioned frequent attempts to convey instructions for road-making in writing. This method has never been entirely successful; it being impossible to acquire a mechanical art without actual practice; or to obtain any just ideas of it, beyond the first principles, from books.

These principles are, that a road ought to be considered as an artificial flooring forming a strong, smooth, solid surface, at once capable of carrying great weight, and over which carriages may pass without meeting any impediment.

Directions for Repair of an old Road, being the substance of a Communication made to a Committee of the Honourable House of Commons in 1811, *and published with the Report by Order of the House, with additions and alterations, deduced from actual practice during the last three years.*

1*st February* 1819.

No addition of materials is to be brought upon a road, unless in any part of it be found that there is not a quantity of clean stone equal to ten inches in thickness.

The stone already in the road is to be loosed up and broken, so as no piece shall exceed six ounces in weight.

The road is then to be laid as flat as possible, a rise of three inches from the centre to the side is sufficient for a road thirty feet wide.

The stones when loosened in the road are to be gathered off by means of a strong heavy rake, with teeth two and a half inches in length, to the side of the road, and there broken, and on no account are stones to be broken *on* the road.

When the great stones have been removed, and none left in the road exceeding six ounces, the road is to be put in shape and a rake employed to smooth the surface, which will at the same time bring to the surface the remaining stone, and will allow the dirt to go down.

When the road is so prepared, the stone that has been broken by the side of the road is then to be carefully spread on it—this is rather a nice operation, and the future quality of the road will greatly depend on the manner in which it is performed. The stone must not be laid on in shovels full,

but scattered over the surface, one shovel full following another and spreading over a considerable space.

Only a small space of road should be lifted at once; five men in a gang should be set to lift it *all across:* two men should continue to pick up and rake off the large stones and to form the road for receiving the broken stone, the other three should break stones—the broken stone to be laid on as soon as the piece of road is prepared to receive it, and then break up another piece; two or three yards at one lift is enough.

The proportioning the work among the five men must of course be regulated by the nature of the road; when there are many very large stones, the three breakers may not be able to keep pace with the two men employed in lifting and forming, and when there are few large stones the contrary may be the case; of all this the Surveyor must judge and direct.

But while it is recommended to lift and relay roads which have been made with large stone, or with large stone mixed with clay, chalk or other mischievous materials, there are many cases in which it would be highly unprofitable to lift and relay a road, even if the materials should have been originally too large.

The road between Cirencester and Bath is made of stone too large in size, but it is of so friable a nature that in lifting it becomes sand; in this case I recommended cutting down the high places, keeping the surface smooth and gradually wearing out the materials now in the road, and then replacing them with some stone of a better quality properly prepared.

In like manner a part of the road in the Bath district is made of freestone which it would be unprofitable to lift.

At Egham in Surrey, it was necessary to remove the whole road to separate the small portion of valuable materials from the mass of soft matter of which it was principally composed.

which was removed at considerable expence, before a road could be again made upon the site.

Other cases of several kinds have occurred where a different method must be adopted, but which it is impossible to specify, and must be met by the practical skill of the Officer whose duty it may be to superintend the repair of a road, and who must constantly recur to general principles. These principles are uniform, however much circumstances may differ, and they must form the guide by which his judgment must be always directed.

When additional stone is wanted on a road that has consolidated by use, the old hardened surface of the road is to be loosened with a pick, in order to make the fresh materials unite with the old.

Carriages, whatever be the construction of their wheels, will make ruts in a new made road until it consolidates, however well the materials may be prepared, or however judiciously applied; therefore a careful person must attend for some time after the road is opened for use, to rake in the track made by wheels.

The only proper method of breaking stones, both for effect and economy, is by persons *sitting;* the stones are to be placed in small heaps, and women, boys, or old men past hard labour, must sit down with small hammers and break them, so as none shall exceed six ounces in weight.

The Tools to be used are,—

Strong picks, but short from the handle to the point, for lifting the road.

Small hammers of about one pound weight in the head, the face the size of a new shilling, well steeled, with a short handle.

Rakes with wooden heads, ten inches in length, and iron teeth about two and a half inches in length, very strong for raking out the large stones when the road is broken up, and

for keeping the road smooth after being relaid, and while it is consolidating.

Very light broad-mouthed shovels, to spread the broken stone and to form the road.

Every road is to be made of broken stone without mixture of earth, clay, chalk, or any other matter that will imbibe water, and be affected with frost; nothing is to be laid on the clean stone on pretence of *binding*; broken stone will combine by its own angles into a smooth solid surface that cannot be affected by vicissitudes of weather, or displaced by the action of wheels, which will pass over it without a jolt, and consequently without injury.

PRICES.

The price of lifting a rough road, breaking the stones, forming the road, smoothing the surface, cleaning out the water-courses, and replacing the stone, leaving the road in a finished state, has been found in practice to be from one penny to two-pence per superficial yard, lifted four inches deep; the variation of price depends on the greater or lesser quantity of stone to be broken.

At two-pence per yard, a road of six yards wide will cost, therefore, one shilling per running yard, or 88l. per mile.

Any rough road may be rendered smooth and solid at this

price, unless it be weak and require an addition of stone, or require some very material alteration of shape.

Breaking stone has been reduced in price by the use of more proper hammers, and the sitting posture.

The Commissioners at Bristol used to pay fifteen pence per ton for limestone from Durdham-Down, for the use of their roads, and broken to a size above twenty ounces.—Stone is now procured from the same place, broken so as none exceed six ounces for ten-pence per ton! and the workmen are very desirous of contracts at that rate, because the heavy work is done by the men, the light work with small hammers by the wives and children, so that whole families are employed.

In Sussex, the proportion is greater between former and present prices; the breaking of flint cost at one time two shillings per ton, and is now done, by introducing a better method and fitter tools at one shilling per ton.

By a more judicious preparation and application of materials the quantity of stone consumed in roads is decreased, by which a great saving of expence is made, and with this great advantage, that the saving is in horse labour of cartage, while the labour price is given to men, and in such a manner as includes boys from the age of ten upwards, women and old men past the age of being able to labour hard. The proportion of men and horse labour in the Bristol district, under the former management, was

One-fourth to men's labour,
Three-fourths to horse labour.

Under a better system of management the proportion has been exactly reversed: during half a year that an exact account was kept, there was paid.

For men's, women and children's labour, £3088.
For horses' labour ..... 1065.

This immense advantage is presented in every part of the country, as roads are confined to no particular place, and are universally in want of repair: ample funds are already provided for every useful and proper purpose, although at present misapplied in almost every part of the kingdom, while the labourers are in want of that employment which it ought to afford them.

TO THE RIGHT HONOURABLE

THE PRESIDENT,

AND

THE BOARD OF AGRICULTURE.

Having communicated to your Honourable Board, some observations on making and repairing roads, in February, 1819, I beg leave to add the following, which have arisen from increased experience on the subject, and also from a desire of calling your attention to the effects of the late severe winter on the roads of the country, and the confirmation afforded to the opinions I have endeavoured to introduce on the construction of roads.

During the late winter, and particularly in the month of January, 1820, when the frost was succeeded by a sudden thaw, accompanied by the melting of snow, the roads of the kingdom broke up in a very alarming manner, and to an extent that created great loss and inconvenience by the interruption of communication, and the

delay of the mails, and also occasioned a very heavy extra expenditure by the Post-office.

The obvious cause of this defect of the roads, was the admission of water from the loose and unskilful method of their construction. Previous to the severe frost, the roads were filled with water, which had penetrated through the ill-prepared and unskilfully laid materials: this caused an immediate expansion of the whole mass during the frost, and upon a sudden thaw, the roads became quite loose, and the wheels of carriages penetrated to the original soil, which was also saturated with water, from the open state of the road. By this means, many roads became altogether impassable, while the whole were rendered deep and inconvenient to be travelled upon.

In particular, it was observed, that *all* the roads of which chalk was a component part, became, generally, impassable; and even, that the roads made over chalk soils gave way in most places. This evidently proceeded from the absorbent quality of chalk, which renders it so tenacious of water, that I consider its use to be one of the most dangerous errors in road making. I was induced on former occasions to recommend particular care in making roads over chalk soils, and to advise a discontinuance of the

practice of mixing chalk, clay, or any other matter that holds water, with the materials of a road. The experience of last winter has confirmed this opinion, and has shewn the ruinous effects of the former method.

Of all the roads which have been thoroughly re-made, according to the directions which I had the honour to submit to your Honourable Board last spring, not one has given way, nor has any delay taken place through the severity of the late season.

As every winter has, in some degree, presented such inconveniences, and as it has been observed that very severe winters occur in England every six or seven years, it is of great consequence to consider of the means of constructing the roads of the kingdom in such a manner as shall prevent their being in future affected by any change of weather or season.

The roads can never be rendered thus perfectly secure, until the following principles be fully understood, admitted, and acted upon: namely, that it is the native soil which really supports the weight of traffic: that while it is preserved in a dry state, it will carry any weight without sinking, and that it does in fact carry the road and the carriages also; that this native soil must previously be made quite dry, and a

covering impenetrable to rain, must then be placed over it, to preserve it in that dry state; that the thickness of a road should only be regulated by the quantity of material necessary to form such impervious covering, and never by any reference to its *own* power of carrying weight.

The erroneous opinion so long acted upon, and so tenaciously adhered to, that by placing a large quantity of stone under the roads, a remedy will be found for the sinking into wet clay, or other soft soils, or in other words, that a road may be made sufficiently strong, *artificially*, to carry heavy carriages, though the sub-soil be in a wet state, and by such means to avert the inconveniences of the natural soil receiving water from rain, or other causes, has produced most of the defects of the roads of Great Britain.

At one time I had formed the opinion that this practice was only a useless expence, but experience has convinced me that it is likewise positively injurious.

It is well known to every skilful and observant road-maker, that if strata of stone of various sizes be placed as a road, the largest stones will constantly work up by the shaking and pressure of the traffic, and that the only mode of keeping the stones of a road from motion, is to use materials of a uniform size from the bottom. In

roads made upon large stones as a foundation, the perpetual motion, or change of the position of the materials, keeps open many apertures through which the water passes.

It has also been found, that roads placed upon a hard bottom, wear away more quickly than those which are placed upon a soft soil. This has been apparent upon roads where motives of economy, or other causes, have prevented the road being lifted to the bottom at once; the wear has always been found to diminish, as soon as it was possible to remove the hard foundation. It is a known fact, that a road lasts much longer over a morass than when made over rock. The evidence produced before the Committee of the House of Commons, shewed the comparison on the road between Bristol and Bridgwater, to be as five to seven in favour of the wearing on the morass, where the road is laid on the naked surface of the soil, against a part of the same road made over rocky ground.

The practice common in England, and universal in Scotland, on the formation of a new road, is, to dig a trench below the surface of the ground adjoining, and in this trench to deposit a quantity of large stones; after this, a second quantity of stone, broken smaller, generally to about seven or eight pounds weight; these pre-

vious beds of stone are called the bottoming of the road, and are of various thickness, according to the caprice of the maker, and generally in proportion to the sum of money placed at his disposal. On some new roads, made in Scotland, in the summer of 1819, the thickness exceeded three feet.

That which is properly called the road, is then placed on the bottoming, by putting large quantities of broken stone or gravel, generally a foot or eighteen inches thick, at once upon it.

Were the materials of which the road itself is composed, properly selected, prepared, and laid, some of the inconveniences of this system might be avoided; but in the careless way in which this service is generally performed, the road is as open as a sieve to receive water; which penetrates through the whole mass, is received and retained in the trench, whence the road is liable to give way in all changes of weather.

A road formed on such principles has never effectually answered the purpose which the road-maker should constantly have in view; namely, to make a secure, level flooring, over which carriages may pass with safety, and equal expedition, at all seasons of the year.

If it be admitted, as I believe it is now very generally, that in this kingdom an artificial road

is only required to obviate the inconvenience of a very unsettled climate; and that water with alternate frost and thaw, are the evils to be guarded against, it must be obvious that nothing can be more erroneous than providing a reservoir for water under the road and giving facility to the water to pass through the road into this trench, where it is acted upon by frost to the destruction of the road.

As no artificial road can ever be made so good, and so useful as the natural soil in a *dry state*, it is only necessary to procure, and preserve this dry state of so much ground as is intended to be occupied by a road.

The first operation in making a road should be the reverse of digging a trench. The road should not be sunk below, but rather raised above, the ordinary level of the adjacent ground, care should at any rate be taken, that there be a sufficient fall to take off the water, so that it should always be some inches below the level of the ground upon which the road is intended to be placed: this must be done, either by making drains to lower ground, or if that be not practicable, from the nature of the country, then the soil upon which the road is proposed to be laid, must be raised by addition, so as to be some inches above the level of the water.

Having secured the soil from *under* water, the road-maker is next to secure it from rain water, by a solid road, made of clean, dry stone, or flint, so selected, prepared, and laid, as to be perfectly impervious to water: and this cannot be effected, unless the greatest care be taken, that no earth, clay, chalk, or other matter, that will hold or conduct water, be mixed with the broken stone; which must be so prepared and laid, as to unite by its own angles into a firm, compact, impenetrable body.

The thickness of such road is immaterial, as to its strength for carrying weight; this object is already obtained by providing a dry surface, over which the road is to be placed as a covering, or roof, to preserve it in that state: experience having shewn, that if water passes through a road, and fill the native soil, the road, whatever may be its thickness, loses its support, and goes to pieces.

In consequence of an alteration in the line of the turnpike road, near Rownham Ferry, in the parish of Ashton, near Bristol, it has been necessary to remove the old road. This road was lifted and re-laid very skilfully in 1816; since which time it has been in contemplation to change the line, and consequently, it has been suffered to wear very thin. At present it is not

above three inches thick in most places, and in none more than four: yet on removing the road it was found, that no water had penetrated, nor had the frost affected it during all the late winter; and the natural earth beneath the road was found perfectly dry.

Several new roads have been constructed on this principle within the last three years. Part of the great north road from London by Hoddesdon in Hertfordshire—two pieces of road on Durdham Down, and at Rownham Ferry, near Bristol—with several private roads, in the eastern part of Sussex.

None of those roads exceed six inches in thickness, and although that on the great north road is subjected to a very heavy traffic, (being only fifteen miles distant from London) it has not given way, nor was it affected by the late severe winter; when the roads between that and London became impassable, by breaking up to the bottom, and the mails and other coaches were obliged to reach London by circuitous routes. It is worthy of observation, that these bad roads cost more money per mile for their annual repair, than the original making of this useful new road.

Improvement of roads, upon the principle I have endeavoured to explain, has been rapidly

extended during the last four years. It has been carried into effect, on various roads, and with every variety of material, in seventeen different counties. These roads being so constructed as to exclude water, consequently none of them broke up during the late severe winter; there was no interruption to travelling, nor any additional expense by the Post-office in conveying the mails over them, to the extent of upwards of one thousand miles of road.

Many new roads, and to a considerable extent, are projected for the ensuing season. Some of them are to be assisted by grants or loans from government, and it will be a great saving of property, and enable government to extend their assistance more effectually, if these roads be made in the most approved and economical manner.

The unnecessary expense attending the making of new roads in the manner hitherto practised, is one great cause of the present heavy debt upon the road trusts of the kingdom. The principal part of the large sums originally borrowed, have been sunk in the useless, and in my opinion, mischievous preparation, of a foundation. This debt presses heavily on the funds of all the roads in England, and, in many cases, absorbs almost their whole revenue in payment

of interest. In Scotland this pressure is still more heavily felt: indeed it is not of uncommon occurrence in that country, for creditors to lose both principal and interest of their loans to roads.

This causes not only a great and unnecessary loss in the first instance, and a deficiency of means for ordinary repair, and maintenance of the roads, but it also discourages the formation of new roads. Were a better and more economical system generally adopted and acted upon, many great additions and improvements of the communications of the country would take place, from which, at present, the landholders are deterred, by fear of the extent of the expense, and the difficulty of obtaining loans of money.

The measure of substituting pavements, for convenient and useful roads, is a kind of desperate remedy, to which ignorance has had recourse. The badness, or scarcity of materials, cannot be considered a reasonable excuse; because the same quantity of stone required for paving, is fully sufficient to make an excellent road any where: and it must be evident, that road materials of the best quality may be procured at less cost than paving stone.

The very bad quality of the gravel round London, combined with want of skill and exer-

tion, either to obviate its defects, or to procure a better material, has induced several of the small trusts, leading from that city, to have recourse to the plan of paving their roads, as far as their means will admit. Instead of applying their ample funds to obtain good materials for the roads, they have imported stone from Scotland, and have paved their roads, at an expense ten times greater than that of the excellent roads lately made on some of the adjoining trusts. Very few of these pavements have been so laid as to keep in good order for any length of time; so that a very heavy expense has been incurred without any beneficial result, and it is to be lamented that this wasteful and ineffectual mode is upon the increase in the neighbourhood of London.

This practice has also been adopted in places where the same motive cannot be adduced: in Lancashire, almost all the roads are paved at an enormous cost, and are, in consequence, proverbially bad. At Edinburgh, where they have the best and cheapest materials in the kingdom, the want of science to construct good roads, has led the trustees to adopt the expedient of pavements, to a considerable extent; and at an expense hardly credible, when compared with

what would have been the cost of roads on the best principles.

The advantages of good roads, when compared with pavements, are universally acknowledged; the extension of pavement is therefore to be deprecated as an actual evil, besides the greatness of the expence. Pavements are particularly inconvenient and dangerous on steep ascents, such as the ascent to bridges, &c. A very striking example of this may be observed on the London end of Black-friars Bridge, where heavy loads are drawn up with great difficulty, and where more horses fall and receive injury, than in any other place in the kingdom. The pavement in such places should be lifted, and converted into a good road; which may be done with the same stone, at an expense not exceeding ten-pence per square yard. This road would be more lasting than the pavement, and, when out of order, may be repaired at less than one-tenth of the expense which relaying the pavement would require.

This measure has been adopted with great success, and considerable saving of expense, in the suburbs of Bristol, where the pavements were taken up, and converted into good roads, about three years ago.

The advantages of the system recommended is so obvious to common observation in the repair of old roads, and has been practised to an extent so considerable, during the last four years, that the minds of most people have become reconciled to it; and objections, founded on old prejudice and suspicion, have given way to experience, but the application of the same principles to the construction of new roads, has necessarily been much more limited. It will, therefore, require more liberality and confidence on the part of country gentlemen, and also more patient investigation of the principles on which the system is founded, before they will allow of its adoption on new lines of road. It is to be hoped, however, that the importance of the subject will recommend it to general consideration.

REPORT

FROM THE

Gt. Brit. SELECT COMMITTEE

ON THE

HIGHWAYS OF THE KINGDOM;

TOGETHER WITH THE

MINUTES OF EVIDENCE

TAKEN BEFORE THEM.

REPORT.

THE SELECT COMMITTEE appointed to take into consideration the Acts now in force regarding the TURNPIKE ROADS and HIGHWAYS in ENGLAND and WALES, and the expediency of additional Regulations for their better repair and preservation, and to report their Observations thereupon from time to time to the House; and to whom the Petitions of Joseph D. Bassett, John Richards Reed, and John Martin; and of several Trustees of Turnpike Roads in the Counties of Middlesex, Kent, Surrey, and Sussex, were referred;—HAVE, pursuant to the Orders of the House, examined the matters to them referred, and have agreed upon the following REPORT:

YOUR Committee considered it their indispensable duty to direct their first attention to the Reports of former Committees, appointed to investigate the same important subject; in these Reports, as well as in the documents subjoined to them, are to be found much scientific information, and many valuable suggestions, which have doubtless tended to aid the progress of improvement in the art of making and preserving roads. Still the object of amending the laws which relate to them has been unattained, the

bills introduced with a partial view to that purpose having been lost in their progress through Parliament, and the suggestions for more general improvements having been allowed to remain without further notice.

If your Committee may be permitted to assign the probable reasons of this discouraging result of the labours of their predecessors, they would venture to suggest, that too wide a field of inquiry was taken to lead to immediate practical benefit: that some of the systems most confidently recommended were of a novel and speculative nature; that the regulations which it was proposed to found on them too strongly affected the interests of vested property; and that even the most valuable information communicated to the House rested upon ingenious theories, which had then been very partially, if at all, reduced to practice, or submitted to fair experiment.

As the considerations which influenced the appointment of the present Committee, avowedly sprung from the successful trial of an improved system of making roads, your Committee have judged it right to institute a particular examination into all the circumstances of that experiment, and the various instances in which the example has been followed.

Mr. John London M'Adam having for many years directed his attention, as a magistrate and a commissioner, to the improvement of roads, was induced to accept the situation of general surveyor of an extensive trust round the city of Bristol.

The admirable state of repair into which the roads under his direction were brought, attracted very general attention; and induced the commissioners of various districts to apply for his assistance or advice.

The general testimony borne to his complete success wherever he has been employed, and the proof that his improvements have been attended with an actual reduction of expense, while they have afforded the most useful employment to the poor, induce your Committee to attach a high degree of importance to that which he has already accomplished. The imitation of his plans is rendered easy by their simplicity, and by the candour with which he has explained them, though ability in the surveyor to judge of their application must be understood as an essential requisite.

Your Committee have dwelt on this improved system of making roads, as a preliminary consideration to any alteration of the laws, being persuaded that it is of essential importance to adapt

the law to new circumstances; that the first step requisite is to take effectual measures for ensuring the *formation* of good roads; and that their preservation afterwads, if proper principles for their repair be once adopted, will require fewer legislative regulations than former inquirers have deemed necessary.

For a full elucidation of the methods pursued by Mr. M'Adam your Committee beg leave to refer to his evidence in the Appendix annexed, as well as to that of his son, and of different Commissioners who had witnessed the success of his plans.

But though your Committee have limited their first inquiries to the actual state of the turnpike roads, and the results of recent plans for their improvement, they have by no means confined their researches to the operations or the opinions of one individual. In the evidence which they subjoin will be found, in the first place, a description of the present general defects of the turnpike roads, given by those whose employments and interest render them best acquainted with the nature and extent of the evil; and this exposition is followed not only by the detail of Mr. M'Adam's system, already alluded to, but by the evidence of other eminent surveyors and civil engineers, under whose superintend-

ence the latest and most perfect improvements have been effected.

Your Committee consider that high praise is due to the superior science exhibited by Mr. Telford, in tracing and forming the new roads in North Wales; but they contented themselves with a general inquiry into his plans, aware that their merits would be particularly brought under the eye of the House in the Reports of the Committee on the Holyhead Roads.

The concurrent testimony of all the witnesses examined by your Committee establishes the fact that the general state of the turnpike roads in England and Wales is extremely defective, but at the same time proves that proper management is alone wanted to effect the most desirable reformation. It is not the least interesting result of the researches of your Committee, that the most improved system is demonstrated to be the most economical; that even the first effectual repair of a bad road may be accomplished with little, if any, increase of expenditure; and that its future preservation in good order will, under judicious management, be attended with a considerable annual saving to the public.

There is no point upon which a more decided coincidence of opinion exists amongst all those who profess what may now be called the science

of road-making, than that the first effectual step towards general improvement must be the employment of persons of superior ability and experience as superintending surveyors.

Your Committee, fully concurring in this opinion, have anxiously considered in what manner this object can be attained with the least expense to the country, and the least injurious or offensive interference with existing customs and authorities.

Various are the plans which have been brought under their consideration for altering the general constitution of the laws affecting the management of Turnpike Roads, proposing either to annex the superintendence and patronage to some of the existing departments of Government, or to constitute a new Board of Commissioners expressly for this object.

Your Committee forbear to detail the reasons which induce them to withhold their recommendation from any of these plans, whatever advantages they might afford in unity or vigour of management.

They are of opinion, that many important reasons exist for leaving generally the direction of the affairs of the different turnpike trusts in the hands of their respective Commissioners, whose experience, character and interest, afford

the best pledges of ability, attention and economy. If your Committee think it necessary to propose, in one respect, an interference with their appointments, it by no means proceeds from any distrust of their judgment or integrity.

The duties of a head surveyor demand suitable education and talents. These qualifications must be fairly remunerated; and it is evident, that the limited extent of the funds of Turnpike Trusts, in general, do not afford the means of paying to such an officer an adequate salary. The difficulty might in many instances be obviated by voluntary associations, but where the system is wished to be universal, it ought not to be left to so precarious a dependence.

The plan to which your Committee, after full consideration, are disposed to give the preference, is that of empowering the magistrates of every county, assembled in quarter sessions, to appoint one or more surveyors general, who shall have the superintendence and management of the turnpike roads within the county, under the authority and direction of the Commissioners of the different trusts. It is not necessary at present to enter on the detailed regulations by which the executive duties of such an officer should be prescribed, so as to keep them under the deliberative control of the

Commissioners, whose meetings he should attend, and to whom he should uniformly report on the improvements and alterations he may wish to recommend within their trusts.

Your Committee are of opinion, that the most eligible mode of paying the salary of this officer would be by an uniform rate per mile upon all the roads within the county; to be fixed by the magistrates at quarter sessions, and paid from the funds of the respective trusts.

The success of this plan of appointing general county surveyors will, in a great degree, depend upon the firmness evinced by the magistrates, in laying aside every consideration of personal favour, and impartially looking to integrity, talents, and energy of character, as the recommendations for office; some skill in the science of an engineer should also be regarded as a valuable qualification.

Your Committee have manifested their general disinclination to any interference with the honourable and gratuitous discharge of the functions of the Commissioners of Turnpike Trusts; in one instance, however, they are disposed to depart from the principle which they have recommended. A full consideration of the evidence relative to the defective state, and injudicious management of the roads round the

Metropolis, and of the advantages which would accrue from a consolidation of the numerous small Trusts into which they are most inconveniently divided, induce your Committee to express to the House their strong recommendation, that a special Act of Parliament may be passed for uniting all the Trusts within a distance of about ten miles round London under one set of Commissioners. It is to these roads that the heaviest complaints made by the coach-masters, and the surveyor of mail coaches under the post-office, principally apply; and whether an improvement is to be effected by the importation of flint, and other common materials, or by laying granite pavement in the centre or sides of the roads, it is evident that, "the measure to be performed in an economical and efficient manner, must be done upon an extended scale; it must become one interest, directed by one select body of men, of weight, ability, and character."

It is the object of the recommendation of your Committee to render the roads round the Metropolis a pattern for the kingdom, by the introduction of the most judicious system of formation and repair, which will thus be brought under general inspection; and the spirit of improvement, radiating from this centre, may

be expected to spread with rapidity throughout the country, and to diffuse "those incalculable public and private advantages," which a former Committee anticipated from the accomplishment of this great national object.

Your Committee are deeply sensible of the consideration due to the persons whose property is invested in the funds of these Trusts, as well as to those who now act as Commissioners. They are perfectly aware of the jealousy with which the House may view any proposition for the creation of new offices of patronage and profit; and they do not disguise their conviction, that it will be found expedient to remunerate those efficient Commissioners who are expected to devote their time to the performance of active duties.

Your Committee however anticipate, that if the House shall approve the formation of a Board of Commissioners for this object, they will deem it proper to place at its head some persons of eminent station and character, as a security for the independence and respectability of its proceedings.

All these considerations certainly require cautious deliberation, and delicacy in arranging the plan; but your Committee feel confident that the wisdom and judgment of the House will

find the means of surmounting the difficulties, without injustice, or hazardous innovation.

It is obvious, that the formation of this distinct central authority will be best effected by the introduction of a separate Bill, while the plan of empowering the magistrates to appoint county surveyors would naturally form part of a general Bill for amending the laws relating to Turnpike Roads.

Your Committee have weighed, with much attention, the comparative advantages of an attempt to amend these laws by supplemental enactments, and of the comprehensive plan of endeavouring to embody in one Act of Parliament all that is valuable in the old laws, with the addition of such new regulations as are acknowledged to be desirable.

The Committee of 1811 were impressed with the expedience of "combining the old and new regulations into one general code, divided into two branches, one regarding the Highways, and the other regarding Turnpike Roads," though they considered that "it would require more time and labour than those who have not had some experience in the drawing up of such laws can be at all aware of."

Your Committee do not hesitate to avow their opinion, that unless this task, however arduous

be accomplished, the laws relating to roads must remain in an incomplete, uncertain, and inconvenient state. They cannot doubt that the House will agree with them that the promotion of such a measure is deserving of legal assistance on the part of his Majesty's government, to those who are disposed to apply their time and attention to the undertaking; and they indulge the hope, that if the House shall think fit to reappoint a Committee for the same object in the next session of Parliament, much may be found done for the preparation of such a bill."

Your Committee themselves have not been inattentive to many of the amendments which they think it ought to embrace, some of which they proceed to particularize for the consideration of those members whose attention may be drawn to the subject of this Report.

There is no object which appears more deserving of regulation than the expense attending the passing and renewing of Turnpike Acts. This might be lessened by comprising in a general Act such customary clauses as are applicable to all trusts, and by dispensing with the attendance of witnesses in London to prove the notices required by the orders of the House; but a still greater advantage would be gained by extending the period of the duration of these Acts, and

providing for their renewal without the payment of fees.

A general commutation for statute labour appears to be required, both for public advantage and private convenience. The amount of composition might be levied as a rate; and it will become a subject of consideration, whether some better principle may not be laid down for apportioning the money thus collected between the highways and turnpike roads.

The advantage of authorizing parish officers to contract with the commissioners for the repair of the roads passing through the parish by labourers belonging to it, has been strongly pressed on the attention of your Committee, but though they are disposed to admit that such a system may often afford desirable relief to the parishes, they are not equally satisfied that it will have a tendency to promote the improvement of the roads. They think it right to bring the proposition under the consideration of the House, though they are too diffident of its utility to venture to add to it their recommendation.

It seems generally admitted, that the present exemptions from toll granted to broad-wheeled waggons require to be revised, as the enormous weights which they carry render them more destructive to the materials of the roads than their

supposed advantage in consolidating them can compensate. Without entering into the yet unsettled controversy respecting the superior utility of conical, barrelled, or cylindrical wheels, for the purpose of draught, it is perfectly evident, that the narrow part of the surface upon which wheels of the two first descriptions meet the ground, cannot give them the advantage of the roller. As soon as impolitic exemptions shall be abolished, and the tolls be regulated upon all carts and waggons, with wheels of a moderate width, in proportion either to the weight carried, or the number of horses, there will no longer be the same temptation to carry excessive loads; and it is probable that a new practice, regulated by private interest, may render it unnecessary to limit the weight allowed to be taken.

Some regulations appear to be absolutely required in respect to the conduct of toll-keepers, and the liability of renters, for the penalties imposed on their servants.

Your Committee have thus noticed a few of those objects of amendment which have presented themselves to their consideration. To reduce these and other proposed improvements into proper form—to digest the various provisions of former Acts—to expunge what is useless or injurious,—to reconcile what is contradictory—to

re-model and arrange what is sound and useful, will require the assistance of the best legal judgment. Your Committee however, after having thus availed themselves of the power granted by the house, of reporting the partial result of their investigations, will continue to make such inquiries, and to collect such materials, as may pave the way for the accomplishment of that important undertaking.

It will at once be seen, that they have confined themselves to one branch of the work committed to them, having conceived it to be more judicious not to distract their own attention and that of the House by too many subjects of inquiry, but to pursue that which they first undertook to a practical result.

Should the House adopt their recommendation of renewing the Committee in another session, the subject of the Highways will naturally engage their attention as soon as they shall have fully matured the plan for amending the laws relating to the Turnpike Roads.

25th *June*, 1819.

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MINUTES OF EVIDENCE.

Martis, 2° die Martij, 1819.

EDWARD PROTHEROE, ESQUIRE,

In the Chair.

Charles Johnson, Esquire, called in; and Examined.

YOU are surveyor and superintendent of mail coaches under the Post Master General?—Yes.

How long have you held that office?—Not twelve months yet.

Has your attention been directed, in the execution of the duties of that office, to the state of the turnpike roads throughout the kingdom?—I have given a general attention to the subject, and I have had occasion, of course, to give particular attention to it, when complaints have been made of loss of time.

In what state of repair do you consider the turnpike roads to be, generally throughout the kingdom?—I certainly (as far as I have had an opportunity of inspecting them) consider, that almost all the roads might be improved; but there are very few instances in which I should have thought it necessary to advise the Post Master General to interfere, except in the more immediate neighbourhood of London.

It is not the practice of the Post-office to interfere in the mode

you mention, by indictment, unless the evil has arisen to a very great pitch?—Not until it has arisen to a very considerable evil.

Do you consider that the general defective state of the road arises from any local disadvantages, or from mismanagement in regard to the funds, or the application of materials?—That question involves so many considerations, that I hardly know how to give an answer to it; but I think, that in general one may observe a great want of that skill in forming the road and keeping it in repair, which is very obvious in some parts of the country.

Do you consider that the defects you have mentioned in the neighbourhood of London, arise from any local disadvantages, or from the roads been worse managed?—It is generally understood that in the neighbourhood of London they have not so good materials to repair the roads with, being chiefly gravel; but I think I may say, that there is certainly a want of attention and of care.

Have you known instances in the neighbourhood of London where better roads have been obtained by superior management?—In the early part of the winter we were under such great difficulties with respect to the Exeter mail coach, that I was under the necessity of applying to the Egham trust. It was at that time reported to me, that the whole town of Egham had been covered with gravel unsifted, eight or nine inches deep from side to side; the consequence of that was, that the mail coach lost ten, fifteen, or twenty minutes every night. We were given afterwards to understand that the commissioners had put that particular road under the care of Mr. M'Adam, and at this time I have no sort of occasion whatever to complain of it.

Generally speaking, do you consider that the mails are detained more by the bad state of the roads in the neighbourhood of London than elsewhere?—They certainly have more difficulty in passing to and from London for the first fifty or sixty miles, than in almost any other part of the country. It is in the night we

have the heaviest weights, and therefore it is very desirable that the roads near town should be rather better, than worse than others.

Has your attention been particularly directed to the state of the roads in other parts of the kingdom lately?—I travelled a considerable distance last autumn in the north of England. Certainly I considered the roads that I passed over there, to be very superior in general to what they are in the first hundred miles from the metropolis. Subsequently to that, I have had occasion to travel throughout North Wales, and I gave particular attention to the Holyhead line of road.

By what road?—By Coventry. The roads which are found in North Wales are remarkably good, and in my humble opinion, show great science in the formation of them. The new roads I mean. The materials in that country are of course very good. On this side of Birmingham, which is also the road to Liverpool, there is great occasion to complain, particularly from Dunchurch to Daventry. At this time that road is in a very neglected state, very heavy, narrow, and blocked up by banks of drift. I have had occasion to apply to that trust, but I do not learn that any thing has been done.

Have you found the system of indictment afford any effectual remedy for the evils which you have had cause to observe in that way?—I think we have. But there have been very few indictments preferred for some years past; the postmaster general not thinking it right to press upon the districts during the season of agricultural distress. I should say, we do not consider that any reason, at present, for abstaining.

Have you experienced from the commissioners, a disposition, generally, to attend to such complaints as you have found occasion to make?—Such applications as I have had occasion to make appear to have been very well received; but I cannot say, that in many instances the roads have been much improved. I will add to this answer, that I lately passed over the road from Oxford

through Henley to London; and although that is one of the roads complained much of, it is certainly, at this time, in a very improper state.

In such cases do you not follow up your measures by stronger proceedings, by indictment?—I think that in this case it would be necessary to renew our applications, and perhaps to proceed by indictment; but I have considered it prudent not to interfere, chiefly in contemplation of the proceedings of this Committee.

From what you have seen of the new roads in Wales, do you not conceive that nearly all the turnpike roads in England are capable of very considerable improvement, by an application of equal skill in the disposition of the materials employed upon them?—I certainly do.

Mr. *William Waterhouse*, called in; and Examined.

YOU keep the Swan-with-two-Necks in Lad-lane?—I belong to the premises; I don't keep the house; I am the coach-master.

You are the proprietor of many mail and other coaches?—I am.

As the proprietor of mail and stage coaches, has your attention been directed to the state of the roads over which they travel?—Yes, it has.

Inform the Committee whether you think the roads are in such a state of repair as they might be, under proper management, with the advantages they possess?—Taking them generally, I think they are not.

Do you consider that the amount of the tolls at present received would be sufficient to place them in a state of good repair, under proper management?—From what information I have been able to obtain of the sums which the gates are let for upon several trusts, it is my opinion that the money so received is quite sufficient to put them in a very good state. For instance, there is one trust, which is called the Daventry trust, leading

from Old Stratford to Dunchurch; their tolls, I understand, produce more than 100*l.* a mile per annum. Very little improvement has been made in that trust; and the roads are very unsafe, and in a bad condition altogether.

Do you consider that that arises from want of proper materials, or want of proper skill in making use of them?—From both. The materials that they have in that neighbourhood, in my opinion, are not good; and the people that they employ upon the roads are not equal to the task, and therefore they are very much neglected. The surveyors and the men that work under them are insufficient.

Do you know of any instances where similar disadvantages have been surmounted by proper skill and ingenuity?—I believe I can state that upon one particular trust that has been the case. I believe they call it the Hockliffe trust. It is but a short distance, but very great improvements have been made upon it. The great improvements that have been made there, I am informed by several of the commissioners, have been done through their skilful and attentive surveyors. They have improved that trust very much indeed. I believe I can mention another road out of London that has been much improved, I mean the Essex road, (their surveyor being a clever man, and competent to understand his business,) between Whitechapel church and Brentwood.

Are there any particular defects in the management of the roads generally, which you think might be remedied, that you can point out to the Committee?—In the first place, there may be great improvements by the proper formation of the roads. I know, in some places, particularly from here down to Colney, where there is a clayey bottom, and upon that line of road there are a great many land springs; those springs frequently work up through the gravel, and injure the road very materially. When that is the case I consider that they should under-drain the road, and take away these land springs, which would be the means of

having the roads firm and hard, much harder than they are now.

Is it not a common defect to place the gravel on the road without being sufficiently sifted or washed?—Very much so.

Do you not consider it as a bad system, likewise, to place the gravel so much in the centre of the road, thereby rendering it of too great convexity?—Yes, certainly. I think it is laid generally too thick and too high in the middle. There is no necessity for the roads being rounded so much.

Have you known any accidents to have arisen from the steepness of the road?—Yes; several accidents with my coaches, as well as those of other people, in consequence of the road being laid so very high in the middle.

Is not that shape of the road likewise attended with a disadvantage in the draft of the carriage?—I consider it so, inasmuch as it flings the weight too much on one side.

Is not a great loss sustained by the proprietors of stage coaches, in consequence of the badness of the roads, in the wearing out of their horses?—Yes; particularly so the first fifty or sixty miles from London.

With regard to the performance of time by the mail coaches, do you find that you labour under greater difficulty on the roads near London, than on those at a greater distance from town?—I am certain we do. It requires a greater quantity of horses to perform the duty, and, in my opinion, it requires ten horses to perform the same number of miles for the first fifty out of London, that might be done by eight, with the same speed, beyond that distance.

Is there any difference in the value of the horses used near town and at a distance from it?—I can buy horses at 15*l.* a piece that will perform the duty, at a distance from London, equal to those that we are obliged to give 30*l.* a piece for, on the average, for the work near town.

Are you in the habit of working coaches to a greater distance

than fifty miles from London?—Not at this time; I have worked coaches as far as one hundred miles distance from London, and I always found there that eight horses would perform as many miles as ten, the first fifty miles out of London.

Have not the tolls very much increased of late years under new acts of parliament?—It is my opinion that the tolls generally have doubled within these last fifteen years.

Have the roads improved in any degree in the same proportion?—No, they have not.

Have you calculated the average rate per mile which a coach with four horses pays for toll?—I have: It is my opinion that the average amount throughout the kingdom is 3½*d.* per mile; it was above 3*d.* when I took them above twelve months ago.

Do you find that the horses wear out in a much shorter space of time, in working coaches within the first fifty miles from London, than they do lower down?—Yes they do very much. We calculate that our stock of horses, employed in working the first fifty miles out of London, will not last more than four years; in the country, at a greater distance, I believe they calculate that their stock, on an average, will last six years.

Are you not frequently obliged to put six horses to your coaches, on the roads from London?—Sometimes that is the case; we do work with six horses where the roads are bad and heavy. I may say, from the knowledge I have of one particular road, namely, from London to Birmingham, it requires twelve horses to perform the same number of miles as eight horses will do between Birmingham and Holyhead.

How many coach-horses do you keep?—About four hundred.

Are you acquainted with the new roads in North Wales, made by Mr. Telford?—Yes, I am.

Do you think that three of your horses would draw the Holyhead mail as easily on those roads as four of them do the same coach on any part of the road from London to Dunchurch?—I have no doubt about it.

Does that arise from the construction of the road, or nature of the materials, or both?—Both. The construction of the new road is extraordinarily good, and the materials also are very good.

Can you state what particular construction those roads are of?—They are laid in a form sufficiently round to wash themselves, if there is a shower of rain that comes upon them. They are not very high; and their excellence consists in the smallness of the convexity. They are in the best form I have ever seen roads made.

Mr. *William Horne*, called in; and Examined.

You keep the Golden Cross Inn, Charing Cross?—Yes.

You are the proprietor of many mail and stage coaches?—I am.

Your attention of course has been directed to the state of the roads over which they travel?—It has.

Can you inform the Committee in what state the roads generally are, in point of goodness?—I think in general they have been better for the last seven years than formerly, though they are now bad. They are generally bad, and might be very much improved.

Can you state to the Committee any particular instances of improvement that have taken place within your own knowledge?—Yes; one between London and Hounslow, which must be known to every body to have been very bad; that road has been made good, which was extremely bad before.

Do you consider that the application of the materials upon that road is at present good?—Yes. It is the better construction of the road, together with the different materials from what they used formerly, which have been the means of making that road better. They have brought chalk and flints from Kent by the canal, and have got them at as small an expense as gravel;

and these have formed a hard well-bound road, which was formerly bad.

Upon what other roads do your coaches travel?—I will mention one which is precisely the contrary, the Uxbridge road.

Gravel is usually employed on that?—Solely gravel, and the road is very flat. It is made lower than the fields, which draws the water upon it, and therefore it cannot be drawn off from it, That is the chief cause of the road being so bad.

Is it not the practice upon that road to pile up the scrapings or drift by the side of the road?—It is.

Within your experience, do you consider that the goodness of the roads is at all in proportion to the local advantages or disadvantages; or have you found that the skill and experience of the surveyors employed upon them have effected particular improvements?—They chiefly depend upon having good surveyors. The Dover road will show that more than any other road I know of. I can remember that within these seven years, what was then called "The Sun in the Sands" has been made a very good road. That road was all loose and sandy: they have drained it, and it is now a very good road.

Can you state under whose superintendence that road is placed?—Mr. Collis's. He is now employed on the Brighton road, effecting the same sort of improvement; reducing hills, and making the road good.

Do you find that the roads on which your coaches travel, are much worse in the neighbourhood of London than the more distant parts?—I find them worse for coaches near London, but it may be attributed partly to the greater quantity of travelling near London to what there is in the country.

Are the horses that you employ in the stages near London of superior value to those that are employed at a greater distance? —It differs according to the carriage. I think with the stage coaches, the horses out of London are considerably more in value than those employed at a greater distance from London;

and as to mail coaches, *vice versa*. In the country, the day stock of the coaches is very good, but in the night they work them very badly.

Do you find that your horses that are employed in the stages near London, wear out sooner than those at a greater distance?—Much sooner, I should think. I employ about four hundred horses myself, and I am sure I buy one hundred and fifty a year to support the number, and keep the stock in order. I consider that my stock wears out fully in three years.

How much longer on an average, will horses last at a distance from town?—I should think double the time: for these reasons; first, the work is lighter, and next, the food is better; besides which, the lodging of them is better; the stables are airy and more healthy; they have not so often diseases in the country as we have in London.

Are you in the habit of working coaches to any great distance from London?—I work them half way to Bristol; with Mr. Pickwick of Bath, I work to Newbury.

Do you know whether the horses that are employed still lower down upon that road, are considered to have lighter or heavier work?—I should not keep larger horses for that work myself; I should keep short-legged horses, because of the hills.

Which are of less value?—Yes.

Speaking generally, if the same skill and management that you have mentioned in particular districts were generally employed, do you not think that the roads of England and Wales might be put into a very perfect state of repair?—I think, that with better direction as to management, they might be put into a much better state of repair, at the same cost, than they now are. There is a road, called the North-east Road (the way that the Edinburgh mail comes,) which is much improved lately, and without any great expense.

Under whose management is that road?—Of a Mr. Clay. It has been done by rolling the road, and breaking the gravel to

a certain size, not putting it on too large or too small; and taking care to turn the road well. If the road is not turned well, it never will be good.

This roller is a late invention, is it not?—It is. It impresses the gravel, or whatever the material is, into the ground, before the road is scraped; then they proceed to scrape it and take the slush off; this rolls down the ruts as well.

And from your experience, you have every reason to believe that it is of great advantage to the road?—I have worked the Tyburn road, and the White Cross roads, which were as bad as the Tyburn till this practice has been introduced.

Do you know any thing of the Reading road, which Mr. M'Adam has had the superintendence of?—It is a very fair road; it is the best piece of road in that direction.

Can you inform the Committee the weights you are accustomed to carry upon the different descriptions of carriages, mail coaches, post coaches, and heavy coaches?—The post coach loaded is 38 cwt. weight; it is never more than two tons. The mail coach also is not more than two tons, I should think. As to heavy coaches, I only work two of that description out of the 40 coaches that are in my own yard; they are so little used, that they don't generally weigh more than the post coach; they don't carry so much luggage.

What is the weight of the heavy coach?—Not more than the post, because they don't carry so much luggage as some of the post coaches. I reckon 12 passengers one ton, coach one ton, and luggage half a ton.

Have you known of any accidents to your coaches arising from the great convexity of the roads in the neighbourhood of London?—I have had accidents, and they have sometimes been attributed to the horses shying, and plunging the coach on one side, so as to cause it to overturn, from the great roundness of the road

Mr. *John Eames*, called in; and Examined.

You keep the White Horse, Fetter-lane, and are the proprietor of the Angel Inn, St. Clement's?—Yes.

You are the proprietor of several mail and stage coaches?—Yes.

How many horses do you keep?—About three hundred.

What are the principal roads you are in the habit of working from London?—We work the Canterbury, the Cambridge, the Dover, the Norwich, the Portsmouth, and some others.

Do you find that you sustain much inconvenience from the state of the roads over which you travel?—Yes. As to inconvenience, I find much more in the neighbourhood of London than the more distant parts.

How long do you find that your horses upon an average last, that are employed in the first stages from London?—My horses, upon an average, don't last above three years in the fast coaches.

Including the mails?—Yes.

And those horses in the neighbourhood of London, are of greater value than those employed at a distance?—They are.

Upon an average, how long do the horses last that are employed in the more distant parts?—They last as long again.

Do you attribute that in a great degree to the badness of the roads in the neighbourhood of London?—I attribute it to the distress the horse receives from the badness of the roads near town; but I attribute it also in a great degree to the meeting of different carriages, and crossing the road, which makes it more laborious to the horse, though he does not appear to go so many miles.

Do you not consider that that particular evil is occasioned in a great degree by the convexity of the roads in the neighbourhood of London, the materials being generally heaped up in the middle?—I do; it "tears their hearts out," as the coachmen ex-

press it. The roads are inconvenient from the quantity and quality of the gravel heaped in the middle.

Have you known any instances in which a different system has been pursued, and the roads greatly improved, in the neighbourhood of London?—The road from London to Cranford Bridge has been improved of late, and from London to Hounslow more particularly, in consequence of the pavement in the crown of the road, which has done away with the gravelling, or shingle rather.

Is not the gravel upon that road generally employed without sifting or washing?—It is half clay.

Have you known instances in which this inconvenience has been remedied by superior skill and experience in the surveyor of the roads?—Yes; in the same line of road that Mr. Horne referred to; in the Kent road particularly.

If that same skill was employed in the application of materials to the other roads, do you not think that they might be brought generally to the same state of improvement?—I have no doubt of it; there is no question about it. The Surrey road has been improved on the same principle.

What do you call the Surrey road?—From London to Guildford.

Do you know under whose management that is?—I don't know now; a person named Baker had the management of it.

Was it under him it was improved?—Yes.

How many miles of road does that consist of?—Thirty miles.

And it is very much improved?—Yes.

By what means?—The materials are harder than the gravel. He brings the rag flints and breaks them, but in a different manner from other parts of the road. He has improved it so much, that it does not look the same road at all; I can go now sixteen miles better than I could twelve before.

Do you consider that the horses which travel these roads that have been improved, last longer than formerly?—Yes.

You need hardly be asked whether these improvements enable you to carry passengers at a lower rate than before?—Of course; it is the expense of the stock that is the great thing.

If the roads were generally improved, travelling would be cheaper?—Of course.

Veneris, 21° die Maii, 1819.

Mr. *George Botham,* called in; and Examined.

YOU keep the George Inn, at Newbury?—I do.

Are you a proprietor of mail and other coaches?—Yes.

To a considerable extent?—Yes, and have been for some time.

How many horses have you?—More than a hundred.

Your attention has of course been directed to the state of the road between Newbury and London?—Yes.

State any improvement that has taken place in that road?—There is a very great improvement between Marlborough and Twyford.

Under whose directions?—Mr. M'Adam.

In what state was that road before?—It was in a very bad state, and I mentioned it to lord Aylesbury, and he applied to get the materials, and offered to give up any quantity of his land for the widening of the road, which he has done.

In point of fact the road has been widened?—Much widened and much improved.

Can you state what improvement it would make in the draught of the carriages?—Not exactly, but I consider it a very great one.

You cannot state any proportion of the labour of horses in drawing a carriage?—No, not particularly so; I did not expect to be asked, but it is not very material.

In what state is that road, compared with the road from Twyford to London?—I consider the road from Twyford to be a little mended, but it is very bad at present.

Do you think by the adoption of the same system the road from Twyford to London might be equally improved?—I have no doubt of it; the materials are better.

Which of course would make a great difference in the ease of working your coaches?—Yes; I should think we could perform the journey from Newbury to Reading in a quarter of an hour's less time, which is seventeen miles.

Have you, as proprietor of mail coaches, had occasion to express any dissatisfaction to the Post Office, with regard to your present contracts?—Certainly, with very great reason.

Do you think that you should be enabled to continue those contracts at the present rate, if the roads are not put into a better state of repair?—That entirely depends upon the price of corn; we were very great sufferers till lately, that corn has fallen so much: or else my brother, as well as myself, intended to quit the mails, because we were losing a great deal of money.

Do you consider that the system of repairing roads, which has been adopted in that part of the road which you have described as under the superintendance of Mr. M'Adam, is superior to any other that you have seen adopted?—Certainly, I am sure it is, there is no question about it.

And that its general adoption would be highly beneficial to the coach proprietors, and to the public?—Most certainly.

Mr. *Fromont* being prevented by an accident from attending the Committee, it was resolved that the following Letter be entered on the Minutes:

Gentlemen, Thatcham, May 1819.

I think it a duty incumbent on me to present to you my opinion respecting Mr. M'Adam's plan of repairing and im-

proving turnpike roads. From what I have noticed of his improvement on different parts of the Bath road, on which I am at present working different coaches a distance of above 500 miles per day, I think his plan altogether, *i. e.* first of screening and cleansing the gravel, and breaking the stones; secondly, of preparing the road to receive it; and thirdly, of laying it on the road, is the best and safest method I have ever seen in the course of fifty years experience in the coach and waggon business. I have formerly had several accidents happen from the gravel being laid too thick and very high in the middle of the road; and have killed some hundreds of horses (extra) in pulling through it; and I think I may venture to say, that if Mr. M'Adam's plan was adopted generally throughout the kingdom, in the course of a short time the public would be enabled to travel with much greater ease and safety, and at nearly one-third less of expense; at all events I am convinced that nearly one-third less labour is required to work a fast coach over part of the road between Reading and London, where M'Adam's plan has been adopted, than there is over other parts of the road where they still continue the old plan. In short, my opinion may be given in a few words; his plan, if adopted generally, will cause the traveller to find easier, safer, and more expeditious travelling, and the owners of horses a diminution of nearly one-third of the original labour.

I am, Gentlemen, with respect,

Your most obedient servant,

Edward Fromont.

Jovis, 4° die Martii, 1819.

John Loudon M'Adam, Esq. called in; and Examined.

I BELIEVE, Mr. M'Adam, you reside at Bristol?—Yes, I do.

And have under your care a considerable district of the turnpike roads in that neighbourhood?—Yes, about one hundred and eighty miles of road in that neighbourhood.

How long has your attention been particularly directed to the state of the public roads of the kingdom generally, and the means of their improvement?—About twenty-five years.

Are you a professional civil engineer?—No.

Be pleased to state to the Committee the general state of the turnpike roads at the time you first directed your attention to them, about twenty years ago?—I think the state of the roads twenty years ago, was worse generally than at present, and in particular places much worse. If the Committee would indulge me, I would mention what first led me to these considerations. On my first arriving from America in the year 1783, at the time the roads were making in Scotland (their Turnpike Acts being in operation about twenty years at that time,) very many of their roads were unmade. I was then appointed a commissioner of the roads, and had occasion in that capacity to see a great deal of road-work.

Where?—In Scotland. This first led me to inquire into the general method of road-making, and the expense of it. Since that period, I have been mostly in Bristol, where I was also appointed a commissioner of the roads; the very defective state of which could not fail to attract my attention. I was induced to offer myself to the commissioners, to take charge of the roads as a surveyor, because I found it impossible for any individual commissioner to get the roads put into a situation of being mended with any prospect of success; and no individual could incur the expense of making experiments on a great scale. The roads of Bristol were accordingly put under my direction in the month of January 1816

That was when you were appointed surveyor?—Yes, I have travelled at various times, during the last twenty years, to ascertain which are the best roads, and which the best means of

road-making over the whole kingdom, from Inverness in Scotland to the Land's End in Cornwall. I have obtained all the information that an unauthorized person could expect to receive. In the course of travelling through the country, I have generally found the roads in a very defective state, certainly much worse in particular parts of the country than in others; and in particular counties I have found some parts of the roads much worse than in other parts of the same county. The defects of the roads appear to me to proceed from various causes, but principally from the large use of a mixture of clay and chalk and other matters, that imbibe water, and are affected by frost. Such roads become loose in wet weather, so as to allow the wheels of carriages to displace the materials, and thereby occasion the roads to be rough and rutty. More pains, and much more expense, have been bestowed on the roads of late years, but without, in my opinion, producing any adequate effect, from want of skill in the executive department. I consider the roads in South Wales, in Monmouthshire, in Cornwall, in Devonshire, in Herefordshire, in part of Hampshire, in part of Oxfordshire, and some part of Gloucestershire, are managed with the least skill, and consequently, at the heaviest expense. The paved roads of Lancashire appear to be very unprofitable, and very expensive. I shall mention to the Committee a few roads which I think in a better condition and under a better system of management. Eastward of Bridgewater in Somersetshire, near Kendall in Westmoreland, and near North Allerton, in Yorkshire, the roads appear to be in a much better state than in other parts of the kingdom; and there is a striking difference in the moderate rate of their tolls, which I have always found most moderate where the roads are best managed. I consider the reason of the roads in those parts being in a better condition than in other places, is from greater skill and attention being paid to the preparation of the materials, and the manner of laying them on the roads.

Does the superiority of roads, in certain places that you have

mentioned, arise from their better materials in those neighbourhoods?—No; the same material is found in many parts of the kingdom with much worse roads.

Then, in general, you impute the badness of the roads solely to the applying of the materials?—Yes.

And also to the formation of the roads?—That I consider as part of the application of the materials.

Has there prevailed of late years a general spirit of improvement, in different parts of the country, with regard to the roads —I think there has, and particularly in the west country.

What instances have come within your own knowledge?—The roads immediately round the city of Bristol to the extent of 148 miles, round Bath to the extent of 49 miles, between Cirencester and Bath to the amount of 32 miles, the roads of nine trusts in the eastern parts of Sussex amounting to 97 miles, at Epsom in Surrey amounting to 20 miles, at Reading in Berkshire six miles, amounting in the whole to 352 miles, have been put into a very good condition; in addition to which, there are now under repair, five trusts in Wiltshire and Berkshire, amounting to 108 miles; six trusts in Middlesex, Cambridge and Huntingdon, amounting to 91 miles; six trusts in Devonshire, Buckinghamshire and Glamorganshire, amounting to 129 miles; making a total of 328 miles under repair. These are roads that have been mended, or are now mending, under directions which I have given, or which have been given by my family.

You are not particularly acquainted with the improvements taking place under the management of other persons?—Not particularly; but I have some knowledge of some of them from circumstances.

You have not taken under observation the great road to Holyhead?—No; that I understand is a new road. You asked me with respect to the spirit of improvement; I would wish to explain in what way I think that is proceeding. I have been sent for and consulted by 34 different sets of commissioners, and

as many different trusts, and in 13 counties, to the extent of 637 miles, all of whom have been making improvements, and I have had many sub-surveyors instructed and sent to various parts of the country, at the request of commissioners; many surveyors also in the neighbourhood where improvements are making, have availed themselves of the opportunity of having instruction. Thus the surveyors of Southampton and that neighbourhood have attended to what is doing at Salisbury and Wilton; thus the surveyors at Kingston and Guildford have profited by the improvements at Epsom in Surrey.

On which road are the 20 miles that you mentioned at Epsom?—From Epsom to Tooting, and then across the country to Kingston. Several surveyors near Reading in Berkshire have imitated, with considerable success, the improvements on that road. Mr. Clay, who has contracted for the repair of the ingsland road near London, engaged a young man who was in my office at Bristol, Mr. Marshal, whom he sent afterwards to Leeds in Yorkshire. It has been my study to give every facility to spread information.

Has your attention been directed to the roads in the neighbourhood of London; and can you state to the Committee whether any corresponding improvement has taken place in this district?—I think less improvement has taken place round London than in the country. On the new Surrey roads the example set by the pieces of road made at Blackfriars and Westminster bridges has induced a little amendment; the materials have been more carefully broken, and they have continued to use the hammers, rakes and other tools which were recommended to them; but the general improvement is unimportant: and I am not aware that any alteration has taken place in the system of expenditure, and the mode of being supplied with materials, or in employing more competent surveyors.

From the experience you have had in the improvements that have taken place, have you found that these have been attended

generally, with an increase or diminution of expense?—In general the expense must be diminished by the improvements. The repairs of one hundred and forty-eight miles round Bristol, and many expensive permanent improvements and alterations, have been made in the last three years, during which a floating debt of upwards 1,400*l.* has been paid off, a considerable reduction of the principal debt has been made, and a balance of a considerable amount is remaining in the hands of the treasurer, applicable to further alterations, or to the payment of part of the debt, at the discretion of the commissioners.

Can you state what proportion that is?—I think the first year, 723*l.*

What is the amount of the whole debt?—The whole debt is 43,000*l.* I said a considerable reduction of the principal debt had been made, I did not use the word proportion. I can mention that the balance in the hands of the treasurer, on the last settlement of the account amounted to 2,790*l.* 0*s.* 4*d.* in the Bristol district, beside a considerable diminution of the debt, and beside alterations and improvements.

That applies only to one hundred and forty-eight miles round Bristol?—Only to the one hundred and forty-eight miles round Bristol. The Bristol district has been under one trust for twenty years, and in that period the debt has increased to 43,000*l.*

You will be kind enough to furnish the Committee with a statement similar to that which was supplied by you to the Holyhead Committee, down to the latest period?—I will. Bristol is the only district for which I can have precise figures, I have not had the finances in my own management or direction with respect to the others. As I have only advised with respect to them, I cannot give you the items; and I must say, that my information with respect to other roads, must be much more general than with respect to this road. In Sussex, the roads in nine trusts have been mended with a considerable diminution of the former expense, and the thanks of a general meeting of the trustees

of the Lewes trusts were unanimously voted to Lord Chichester "for the introduction of this system, by which the roads had been so much improved, and the country was likely to derive so much benefit."

Have you found that a similar diminution of expense has taken place where the materials have been bad, as where they have been good?—Yes, I have.

Do you find your mode of management equally applicable where the materials are bad as where they are good, and that the same proportionable benefit arises?—I am afraid gentlemen suppose that I have some particular mode of management, which is certainly not the case, nor can by any means be the case; and in every road I have been obliged to alter the mode of management, according to the situation of the roads, and sometimes according to the finances. At Epsom in Surrey, the roads have been put into a good repair, at an expense considerably under the former annual expenditure, by which the trustees have been enabled to lower their tolls on agricultural carriages. The road between Reading and Twyford, in Berkshire, has been made solid and smooth since the beginning of July last, by persons under my directions, at an expense, including the surveyor's salary, not exceeding fifteen pounds per week; and their former expenditure, exclusive of the surveyor's salary, was twenty-two pounds per week. A great part of the road in the neighbourhood of Bath, which was formed upon the plan laid down in my report to the commissioners, and with the greatest success, is made with freestone, which was always supposed impossible to make a good road of; but it will make a good road. It certainly does not last so long as one made of better materials; but it is equally good whilst it does last. One of the roads out of Bristol towards Old Down has been made good, where it was a received opinion, that from the nature of the materials the road could not be made so; and the commissioners would not consent to my beginning it until the road was threatened to be indicted. It was put into my hands in October 1816, and at

the Christmas following I was able to report that it was one of the best roads in England for a distance of eleven miles, at the expense of first outlay only of 600*l.* and it has continued so until the present.

Please to inform the Committee, what are the means, in your opinion, the most eligible to be adopted for the amelioration of the roads throughout the kingdom?—That question, I think, divides itself into two branches: The operative part, in making the roads, and the care of the finances, and the mode of their expenditure. I should imagine the operative part of preparing roads cannot be effected without procuring a more skilful set of sub-surveyors; young men, brought up to agriculture and labour must be sought, and regularly instructed. It is a business that cannot be taught from books, but can only be acquired by a laborious practice of several months, and actual work upon roads, under skilful road-makers. Young men who have been accustomed to agricultural labour are fittest to be made road-surveyors, as their occupations have given them opportunities of being acquainted with the value of labour both of men and horses. But I should greatly mislead the Committee if I did not inform them, that skill in the operative part of road-making cannot alone produce a reformation of the multitude of abuses that are practised in almost every part of the country, in the management of roads and road funds. These abuses can only be put down by officers in the situation of gentlemen, who must enjoy the confidence, and have the support of commissioners, and who must exercise a constant and vigilant inspection over the expenditure made by the sub-surveyors. They must be enabled to certify to the commissioners that the public money is judiciously and usefully, as well as honestly expended; without this control and superintendence an end cannot be put to the waste of the public money, and all the various modes that are injurious to the public interest, the amount of which would appear incredible, could it be ascertained; but which, I conscientiously

believe, amount to one-eighth of the road revenue of the kingdom at large, and to a much greater proportion near London.

Do you mean the frauds amount to one-eighth?—No, not direct frauds, I call it mis-application; it must not be concealed, that the temptations with which, even a superior officer will be assailed, the facility of yielding to them, and the impunity with which transgression may be committed, require great delicacy in the selection of persons to fill the situation; and encouragement to make this a profession must be in proportion to the quality of the person required.

Do you not consider one of these mis-applications to be the injudicious use of the labour of horses, instead of that of men, women and children?—I do consider that to be a great mis-application of the labour of horses. I am afraid that gentlemen may understand, from what I said, that frauds are committed to the amount of one-eighth, but I meant no such thing; I meant the loss arising from mis-application generally. I have in general found a great deal more materials put upon the road than are necessary, and I am of opinion that is one of the chief causes of the waste of the public money.

Do you think the loss arises, in most instances, from mistake, or from any abuse in regard to the power and patronage which the situation confers?—I think it proceeds from mistakes and ignorance mostly.

Please to explain to the Committee in what way you think the labour of men, women and children, may be substituted for that of horses?—I have generally found that a much greater quantity of materials have been carted to the roads than are necessary, and therefore the increase of horse-labour has been beyond any useful purpose, and that generally the roads of the kingdom contain a supply of materials sufficient for their use for several years, if they were properly lifted and applied; this is to be entirely done by men, women, and children, men lifting the

roads, and women and boys, and men past labour, breaking the stones which were lifted up.

By lifting the road, you mean turning it up with the pick-axe?—Yes; that I consider as man's work; taking up the materials and breaking stones, I consider the work of women and children, and which indeed ought to have been done before those materials had been laid down.

How deep do you go in lifting the roads?—That depends upon circumstances, but I have generally gone four inches deep; I take the materials up four inches deep, and having broken the larger pieces, I put them back again.

Please to explain to the Committee the mode of breaking the stones so as to admit of the labour of men, women and children?—When the stones of an old road have been taken up, they are generally found of the size that women and boys can break them with small hammers, and therefore I would propose to employ these people to break those stones always before they are laid back in the roads.

Is it your plan for those people to break those stones standing, or in a sitting posture?—Always in a sitting posture: because I have found that persons sitting will break more stones than persons standing, and with a lighter hammer.

Does that apply to all materials?—To all materials universally.

Does the plan which you have mentioned of breaking up the roads, apply to gravel roads, or only to those roads composed of hard stones?—In gravel roads and in some other roads it would be impossible to break them up to any advantage; and in several places which I will explain, I should think it unprofitable to lift a road at all. There is a discretion of the surveyor, or the person who has the execution of the work, which must be exercised. I did not order the road in the neighbourhood of Reading to be lifted, but I directed wherever a large piece of flint was seen, it should be taken up, broken, and put down

again; and I directed the road to be made perfectly clean—I am speaking of a gravel road now—and I directed that additional gravel should be prepared in the pits by screening the dirt very clean from it, breaking all the large pieces and bringing that upon the road in very light coats not exceeding two inches at a time; and when those coats were settled, to bring others of very clean materials upon the road, until it settled into a solid smooth hard surface, and which the coachmen in their mode of expression, say "runs true." The wheel runs hard upon it; it runs upon the nail.

Uninfluenced by the state of the weather?—Perfectly so.

In your experience, have you observed that on gravel roads the materials are generally very unskilfully and improperly applied?—Generally so. I think always I may say, for I think I never saw them skilfully or properly managed.

Have you adopted the mode of washing the gravel?—No; I think that is a more expensive process than is necessary.

Do you think it more expensive than screening?—A great deal more so, and I have another reason for objecting to that, with respect to the gravel near London; the loam adheres so strongly to it that no ordinary washing will clean it. The loam is detached from the gravel by the united effort of the water on the road, and the travelling, by which the roads near London become so excessively dirty; but it would be impossible to detach the loam from the gravel in the pits, by throwing water on it; I have tried the experiment and know the fact.

To what particular practice do you allude, when you inform the Committee that gravel is unskilfully applied to the roads in general?—I see that on gravel roads, the gravel is put on after being very imperfectly sifted, and the large pieces not being broken, and the gravel is laid on the middle of the road and allowed to find its own way to the sides. Now the principle of road-making I think the most valuable, is to put broken stone upon a road, which shall unite by its own angles, so as to

form a solid hard surface, and therefore it follows, that when that material is laid upon the road, it must remain in the situation in which it is placed without ever being moved again; and what I find fault with putting quantities of gravel on the road is, that before it becomes useful it must move its situation and be in constant motion.

In order to attain the advantage you allude to in the angular materials, I take it for granted, it is your plan to have the larger pieces of gravel well broken?—Certainly; but I mean further, that in digging the gravel near London, and places where there are vast quantities of loam, and that loam adhering to every particle of the gravel, however small, I should recommend to leave the very small or fine part of the gravel in the pits, and to make use of the larger part which can be broken, for the double purpose of having the gravel laid on the road in an angular shape, and that the operation of breaking it is the most effectual operation for beating off the loam that adheres to the pieces of gravel. There are other cases besides that of gravel, in which I should think it unprofitable to lift a road. The road between Cirencester and Bath is made of very soft stone, and is of so brittle a nature, that if it were lifted it would rise in sand, and there would be nothing to lay down again that would be useful. I should not recommend lifting of freestone roads for the same reason, because it would go so much to sand that there would be very little to lay down again. I will explain what I have done to that road between Cirencester and Bath; I was obliged to lift a little of the sides of the road in order to give it shape, but in the centre of the road, we, what our men call, "shaved it;" it was before in the state which the country people call "gridironed," that is, it was in long ridges with long hollows between, and we cut down the high part to a level with the bottom of the furrows, and took the materials and sifted them at the side of the road and returned what was useful to the centre.

Can you state whether the plan adopted on this road has increased or diminished the expense?—I think the expenses, by the last account, were rather within the expenditure of the former year, even including the new surveyor's wages. They had been in the practice of allowing about 32*l.* a week to the two surveyors as the ordinary expenditure; I directed the new surveyors not to exceed that sum upon any account whatever, including their own wages: but formerly they paid that sum, and paid the surveyor his wages at the end of the quarter or half-year in addition: therefore I consider the sum expended upon the road is rather within the former expenditure than otherwise, except with regard to two dangerous slips which took place at Swainswick-hill, which I consider as perfectly extra.

In the formation of roads under your management, to what shape do you give the preference; I allude to the convex shape or the flat?—I consider a road should be as flat as possible with regard to allowing the water to run off at all, because a carriage ought to stand upright in travelling as much as possible. I have generally made roads three inches higher in the centre than I have at the sides, when they are 18 feet wide; if the road be smooth and well made, the water will run off very easily in such a slope.

Do you consider a road so made will not be likely to wear hollow in the middle, so as to allow the water to stand, after it has been used for some time?—No; when a road is made flat, people will not follow the middle of it as they do when it is made extremely convex. Gentlemen will have observed that in roads very convex, travellers generally follow the track in the middle, which is the only place where a carriage can run upright, by which means three furrows are made by the horses and the wheels, and the water continually stands there: and I think that more water actually stands upon a very convex road than on one which is reasonably flat.

What width would you in general recommend for laying materials on a turnpike road?—That must depend upon the situation. Near great towns roads of course ought to be wider than farther in the country. Roads near great towns ought not to be less than thirty or forty feet wide, but at a distance from great towns it would be a waste of land to make them so wide.

You mean a breadth of thirty feet actual road?—Yes. The access to Bristol for a distance of about three miles, if we had room between the hedges, I would make about thirty feet wide. Between Bath and Bristol I should wish to see the road wide all the way, because it is only the distance of twelve miles between two large cities.

In what way do you make the watercourses at the sides of the road; I ask that question, having observed the farmers, in exercising their power of cleaning out their ditches, dig them to such a depth as to render them dangerous to be passed at night?—I always wished the ditch to be so dug as that the materials of the road should be three or four inches above the level of the water in the ditch, and to that point we endeavour to bring the farmers, but they are very unwilling to clean the ditches at any time when called upon, and when they do it, if they find vegetable mould in any quantity at the bottom of the ditch, they will prosecute their inquiry much deeper than is useful, or proper for safety.

Do you consider you have power by law, at present, for preventing that?—Yes; because the law says, they are to clean them out according to the directions of the surveyors.

In your experience have you found any impediment to the improvement of the roads, from a want of power in the proprietors of different navigations to lower their tolls for conveying materials?—I have found in the river Lea navigation, that the trustees have no power to lower their tolls, which were imposed by act of parliament upon merchandise, and therefore, it

operated in a great measure as a prohibition to carry materials upon that river.

Do you consider it would be to the interest of the proprietors to allow materials to be carried on their navigations at a lower rate than they are empowered to allow by law?—Yes, if they could.

Do you know any similar instance as applicable to canals?—I don't know an instance with respect to canal trusts, but there is an instance with respect to the Bath river at Bristol. No mitigation of the present rate of duty on that river can take place if objected to by any one proprietor, and therefore we have found great difficulty in carrying materials on the Bath river. In one particular place we have been entirely precluded from carrying any.

Have you found any impediment to the improvement of roads arising from the conditions upon which materials are permitted to be conveyed from one parish to another?—Yes; I found that in several cases in the Bristol district. One very strong instance occurred near Keynsham; we had a quarry close to the edge of one parish, and we could not carry the stones from it to the distance of ten yards, without the process of going to the magistrates.

Did you in that case make application to the magistrates?—I did intend to make application, but before I made that application, I found in the very next field, belonging to the same farmer, and in the parish where we required them, the necessary materials, and I was under the necessity of opening both the fields, to the detriment of the farmer's landlord I am persuaded.

Do you know an instance of such an application as that to which you have alluded, having been made to the magistrates, and having been refused?—No, I do not.

Do you think that a great inconvenience and loss of time would be saved if that necessity of application was dispensed with?—It certainly is a great inconvenience, and creates a great

deal of heart-burning in the country, and much dispute. I think the commissioners would very seldom be disposed to carry materials from one parish to another, unless for the general public good.

What depth of solid materials would you think it right to put upon a road, in order to repair it properly?—I should think that ten inches of well consolidated materials is equal to carry anything.

That is, provided the substratum is sound?—No; I should not care whether the substratum was soft or hard; I should rather prefer a soft one to a hard one.

You don't mean you would prefer a bog?—If it was not such a bog as would not allow a man to walk over, I should prefer it.

What advantage is derived from the substrata not being perfectly solid?—I think, when a road is placed upon a hard substance, such as a rock, the road wears much sooner than when placed on a soft substance.

But must not the draught of a carriage be much greater on a road which has a very soft foundation, than over one which is of a rocky foundation?—I think the difference would be very little indeed, because the yield of a good road on a soft foundation, is not perceptible.

To use the expression to which you have alluded, as being used by the coachmen, would a carriage run so true upon a road, the foundation of which was soft, as upon one of which the foundation was hard?—If the road be very good, and very well made, it will be so solid, and so hard, as to make no difference. And I will give the Committee a strong instance of that, in the knowledge of many gentlemen here. The road in Somersetshire, between Bridgewater and Cross, is mostly over a morass, which is so extremely soft, that when you ride in a carriage along the road, you see the water tremble in the ditches on each side; and after there has been a slight frost, the vibration of the water from the carriage on the road, will be so great as to

break the young ice. That road is partly in the Bristol district. I think there is about seven miles of it, and at the end of those seven miles, we come directly on the limestone rock. I think we have about five or six miles of this rocky road immediately succeeding the morass; and being curious to know what the wear was, I had a very exact account kept, not very lately, but I think the difference is as five to seven in the expenditure of the materials on the soft and hard.

Do you mean seven on the hard and five on the soft?—Yes.

And yet the hard road is more open to the effect of the sun and air than the soft road?—It certainly lies higher.

Have you ever inquired of the coachmen, on which of those two descriptions of roads the carriages run the lightest?—Yes, I have; and I have found that there is no difference, if the road be equally smooth on the surface, whether it be placed on the soft ground or hard.

But in forming a road over a morass, would you bottom the road with small or large stones?—I never use large stones on the bottom of a road; I would not put a large stone in any part of it.

In forming a road across morass, would you not put some sort of intermediate material between the bog and the stone?—No, never.

Would you not put faggots?—No, no faggots.

How small would you use the stones?—Not to exceed six ounces in weight.

Have you not found that a foundation of bog sinks?—No, not a bit of the road sinks; and we have the same thickness of materials on the one as on the other.

If a road be made smooth and solid, it will be one mass, and the effect of the substrata, whether clay or sand, can never be felt in effect by carriages going over the road; because a road well made, unites itself into a body like a piece of timber or a board.

In making a road under these circumstances, do you make the whole of the depth of materials at once?—No, I prefer making a road in three times.

Three different times?—Yes.

To what size would you break the hard materials?—To the size of six ounces weight.

Do you not think that is an indefinite criterion; had you not better mention the size?—No; I did imagine myself, that the difference existed to which you allude, and I have weighed six ounces of different substances, and am confident there is little difference in appearance and none in effect; I think that none ought to exceed six ounces; I hold six ounces to be the maximum size. If you made the road of all six-ounce stones it would be a rough road; but it is impossible but that the greater part of the stones must be under that size.

Do you find a measure or ring through which the stones will pass, a good method of regulating their size?—That is a very good way, but I always make my surveyors carry a pair of scales and a six ounce weight in their pocket, and when they come to a heap of stones, they weigh one or two of the largest, and if they are reasonably about that weight they will do; it is impossible to make them come exactly to it. I would beg leave to say, in all cases of laying new materials upon an old road, I recommend loosening the surface with a pickaxe a very little, so as to allow the new materials to unite with the old, otherwise the new materials being laid on the hard surface never unite, but get kicked about, and are lost to the roads; wherever new materials are to be put down upon an old road, I recommend a little loosening; but that I don't call lifting.

Have you stated what thickness of new materials you would lay down on an old road?—I should consider an old road would not want new materials if it had ten inches of materials before, but I should only pick up the materials, and break the large stones; and if there were any want of materials, I would lay on as much as would bring it up to somewhere about the ten inches.

THE MOST NOBLE ORDER OF THE GARTER.
... in 1847. The Motto and Badge are, THE GARTER, of dark blue velvet, inscribed with the motto ... THE MANTLE, of blue velvet; THE HOOD and SUBCOAT, of crimson velvet; THE HAT, of black ... THE GEORGE, or figure of St. George, suspended from a broad ... and THE STAR, ... is restricted to twenty-five ...
... Earl ...
... Henry A. Herbert, M.P.

Would you prefer doing that in dry weather or in wet weather?—In wet weather, always; I always prefer mending a road in weather not very dry.

Are you of opinion that any alteration of the present law, either in regard to the repeal of the present regulations or the enactment of new ones, could advantageously take place in regard to the shape of wheels, and the allowance of weight to be carried in waggons and carts?—I am of opinion that the descriptions of wheels given in all the acts of parliament in the last sessions are the most convenient and useful; and I have thought of the matter very much, without being able to suggest any alteration profitable to the public. With respect to weights, I consider there are very great difficulties in that business. We have weighing machines in the neighbourhood I now am in, and I am persuaded in many instances that they are made instruments of oppression, and in a great many cases the means of committing very great fraud on the commissioners and others; and if some method could be fallen upon by which weighing machines might be dispensed with altogether, and the road reasonably protected, I should think it a very great public advantage. In the new Bristol Act, I have proposed to the commissioners that they should submit to parliament to lay a toll-duty upon the number of horses in a progressive ratio, so as to compel those people who offend to bring in their hands the penalty in the shape of toll; I think it would prevent a great deal of that system of entering into combinations between the toll collectors and the waggoners, which is carried on to a great extent.

Do you think, that if horses in narrow-wheeled waggons were obliged to draw otherwise than at length, it would afford any protection to the road?—Yes.

Has not the practice of making horses draw at length very much a tendency to make the horses follow one track, be the road ever so good?—Yes; and I must mention to the Committee, that the feet of horses on ill-made roads do full as much

mischief as the wheels. It is driving horses in a string that makes a road what the country people call "gridironed;" it is an odd expression, but it is a very significant one.

Do you not believe, that if horses were attached to narrow-wheeled waggons in pairs, it would be found very considerably easier to drive and guide them when abreast, than when placed at length?—I should think it would.

And would it not tend to prevent accidents?—Horses driven in pairs would provide in a great measure against the accidents that arise from the carelessness of those persons who drive them, which is extremely great.

Do you think that if horses were put in pairs to waggons, the power of holding back those waggons when going down a hill, would be so much increased as to prevent the necessity of so frequently locking the wheels?—Certainly it would; because on certain slopes it would not be necessary to lock the wheels; but there are very steep hills where you cannot do without locking.

Is not locking wheels an operation extremely injurious to the roads?—I am not prepared to say it is, if the drag-iron, as it is called, be of a proper description. I followed a waggon lately, with seven tons of timber on it, down Park-street, at Bristol, being a very steep road, with both its hind wheels locked; and this waggon, with this weight of timber on it, and with both the hind wheels locked, did not make the least impression from the top of the street to the bottom. You could discern where the drag-irons had gone, but they had not displaced the materials nor done any mischief.

Don't you find locking generally injurious?—Extremely injurious; on rough roads it is dreadful.

Would not fewer ruts be made if it were more the custom for horses to draw in pairs?—I believe gentlemen are not generally aware of what a rut consists. There are two kinds of ruts, generally speaking: one is a rut produced by displacing ill-prepared materials, and that is the common rut. When a road is made of

ill-prepared materials, the wheel piles them up one upon another, and that forms a very narrow rut, which just holds the wheel; but a rut made by wear upon a smooth surface, is rather a concave hollow than a rut, and will present no difficulty to a carriage in travelling, and that is the difference between a rut produced by wear in a very well-made road, and that produced by displacing the materials.

Is there not much injury done to the roads by the heavy weights both of coaches and waggons?—I am not disposed to think that upon a well-made road the weight of coaches is material, or that it would be judicious to make any legal provisions affecting that subject. In regard to waggons, I conceive that the loads carried upon wheels of the description encouraged by recent acts of parliament, whatever their weight, would be very little injurious to well-made roads. I think a waggon wheel of six inches in breadth, if standing fairly on the road with any weight whatever, would do very little material injury to a road well made, and perfectly smooth. The injury done to roads is by these immense weights striking against materials, and in the present mode of shaping the wheels they drive the materials before them, instead of passing over them, because I think if a carriage passes fairly over a smooth surface, that cannot hurt the road, but must rather be an advantage to it, upon the principle of the roller.

Are you not of opinion that the immense weights carried by the broad-wheeled waggons, even by their perpendicular pressure, do injury by crushing the materials?—On a new-made road the crush would do mischief, but on a consolidated old road the mere perpendicular pressure does not do any. But there is a great deal of injury done by the conical form of the broad wheels, which operate like sledging instead of turning fairly. There is a sixteen-inch wheel waggon which comes out of Bristol, that does more injury to our roads than all the travelling of the day besides.

Are you of opinion that any benefit arises from those broad-

wheeled waggons, which would justify their total exemption from tolls?—None at all.

Does the answer you have given to the Committee relative to the effect of great weights, apply equally to roads made with gravel, as well as broken stone?—I mean it to apply to all well-made roads, whether of gravel or of other materials.

You mean after the road is smooth and solid?—Yes.

But with regard to a new road, are you not of opinion that the materials are crushed and worn out by a great weight?—Yes; no doubt that is so on a new-made road, and one of those waggons with the wheels made conical, would crush a greater proportion of stone than it ought to do.

Do you not conceive that the state of the turnpike roads would be improved by not allowing any waggons to carry more weight than four ton?—I don't know that that would make any great difference, under good management. I think the defect lies in a want of science in road-making.

Martis, 9° die Martii, 1819.

John Loudon M'Adam, Esquire, called in; and Examined.

IN your evidence last week, you stated that less improvement had taken place in the roads in the neighbourhood of London than in any other district, to what causes do you attribute this circumstance?—I consider the principal cause to be the small extent of the trusts, and the peculiar situation of London, which increases the bad effects of the division into very small trusts.

What are the particulars of the situation to which you allude?—The situation of most of the roads near London is very low, difficult to be kept free from water, the traffic is very great both in weight and number, and therefore requiring more skill, as well as more care and attention, than the other roads of the kingdom; the material found near London for making the roads is

gravel of a very bad quality, it is mixed with an adhesive loam that cannot be separated from the gravel, except by the united power of water and friction; this operation cannot be effectually performed before laying it on the roads, but is done by the rain and the traffic, producing a stiff mud, which is not only in itself an impediment to travelling, but has the effect of keeping the roads loose; the form of the gravel is also unfavourable, being smooth round masses of flint, without any angles by which the parts might unite. On the other hand, London is placed in a situation peculiarly convenient for being supplied with materials from a distance, by water carriage. The materials that may be so procured are of the very best description, and, under the sanction of parliament, may be procured on very moderate terms. The Thames furnishes gravel of a very good quality and quite clean; by using this gravel, the navigation of the river will be improved; the several canals, the Surrey, the Grand Junction, Paddington, and river Lea navigation, present facilities for procuring clean flint of the best kind; the coast of Essex, Kent, and Sussex, can furnish a supply to any extent of beach pebbles, one of the best road materials in the kingdom. Granite chippings might be obtained occasionally from Cornwall, Guernsey and Scotland, as ballast; two pieces of road were made with these materials near London, without any mixture of land gravel, at Blackfriars Bridge and Westminster Bridge.

What are the impediments which, in your opinion, prevent the commissioners of the roads near London from availing themselves of those advantages?—The very small trusts into which the roads in the immediate vicinity of London are divided, is the principal cause; this renders it impossible for commissioners to enter upon the plan of procuring materials upon an extended scale, and they cannot be obtained with any regard to economy, except in quantity, with a view to a supply for the whole roads, proceeding from the stones of London to a certain distance. There are also some impediments arising from particular laws,

regulations and customs, which can only be removed by parliament. The Ballast Act gives a right of pre-emption to the Trinity House of all stone and other materials brought as ballast into the Thames. The coasting duty on stone operates as a prohibition to the importation of stone as merchandize; the amount of canal duties payable on merchandize prevents the carriage of road materials on all inland navigations; manure so transported has been protected in most Canal Acts, but road materials have not been considered. Should parliament be pleased to remove these difficulties, the London roads may be rendered independent of the gravel of the country, by a moderate exertion of statistical and mercantile information on the part of the officers employed by the commissioners.

If the Committee understand you right, you give a decided preference to materials thus imported, over the gravel to be found in the neighbourhood of London?—I do.

Is it your opinion, that by proper regulations a sufficient supply of those materials to which you have alluded, could be procured for the whole of the roads in the neighbourhood of London?—Yes, I think there might; because a steady and constant demand, even at a low price, would insure importation, and this demand can only be steady if the roads round London were consolidated under one set of commissioners acting for the whole, and having depôts into which they could receive materials at all times at a fixed price, to be distributed wherever wanted, by an assurance of a ready purchaser; vessels coming in ballast, or not fully loaded, from any place where good road materials were to be procured, would be induced to take on board sufficient to make up their loading; contracts could also be made for flint by the various canals, and upon terms more moderate than the present price of gravel; I am unable to lay before the Committee a detailed plan for supplying the London roads with good and cheap materials, which requires a considerable time and attention in the inquiry.

Is there any other information connected with the improvement of the roads in the neighbourhood of London, which you think you could give to the Committee?—I am quite satisfied that the materials to be imported into London would make good roads, because I made two pieces of very excellent road with those materials at the two bridges, without making use of any gravel of the country.

At what time was this done?—The pieces of road were made in August and September 1817.

What was the extent?—There were about 200 yards of the one, and about 180 yards of the other; one of them joins the iron pavement at the foot of Blackfriars bridge; and the other joins the Marsh-gate turnpike, and goes to the Asylum; those roads were made with river-gravel and pebbles from the coast.

From whence did you get the river-gravel?—It was purchased from the steam-engines that raise it in the river.

Did you lift the old road?—I took up all the stones that were in them that were good for any thing, the flints and other stones, and then made use of a considerable quantity of additional materials to make the surface of the road afterwards.

Was the expense considerable?—There was no account kept of the expense of the experiment at Westminster bridge, because the commissioners wished me to employ a number of paupers and persons that had been on the road before, without discharging them, who were very indifferent hands; and they also wished that the road should be very considerably above the level than I thought necessary, and that brought much more materials than otherwise need have been put on; but the Blackfriars bridge experiment cost about seven-pence halfpenny per square yard; there was a very correct account kept of it, including the price of materials and labour, and every thing.

Could you state what that would amount to for a mile?—That would depend upon the breadth of the road.

At what rate per mile would be the expense of such an improvement, supposing the road thirty feet wide?—About 528*l.* or 530*l.*

Is not a road constructed with a road-way of sixteen feet breadth of solid materials, and with six feet on each side of that with slighter materials, a sufficient road for the general purposes of country travelling?—Yes; and generally the roads round Bristol are made with stone, about the breadth of sixteen feet.

In your former answer respecting materials, you made use generally of the term roads "round London," to what extent did you mean to convey the idea of that improvement?—I should think that the river, and the facility of the canals, might in all places allow you to carry the improvement ten miles round London; and perhaps where the canals or rail-ways come through the country, you might carry the improvement farther.

Has not the system of road management at present practised, the effect of repressing efforts for acquiring skill and exertions of science, as connected with the business of road-making?—I think it has.

Will you explain in what way?—Because the surveyors at present appointed are not required to have any particular skill in their business before they are appointed; but the appointment generally takes place to provide for some person a situation; and the want of superior officers over the sub-surveyors is the means of preventing those sub-surveyors from acquiring a knowledge necessary to execute their duties under an officer who would know whether they were able to execute them or not.

You mean that there is a not a sufficient degree of inspection and control provided by the legislature over the conduct of the surveyor of the roads?—I think so.

Do you conceive that a more scientific system of management of roads is wanted universally?—I do.

Do not you conceive that the want of this scientific system

leads to a great waste of public money?—I think it leads to a great waste of public money.

And also to a great waste of property in horses and carriages? —I think it does.

Has any estimate ever been made of the extent of that loss? —There can be no accurate estimate of a loss so universal as that of the waste of horses and carriages by bad roads; but the Committee of 1811 estimated the saving which would be made to the country by putting the roads in a proper state of repair, at a sum equal to five millions annually.

What remedy would you propose to cure the defects of the the general system of road management?—My opinion is, that the only cure would be to have people of a better station of life placed over them in the direction of this business; that each county or large district in the country ought to have an officer in the character of a gentleman, to oversee the surveyors of the district; not only to direct them what to do, but to see that the work is judiciously and honestly executed; and I think a very small proportion of the sum now wasted by bad management would pay for such an establishment.

Would you alter the trusts?—That would be a great advantage, if the trusts could be consolidated; but there are objections to that, and very serious objections.

Local objections?—Yes, such as the debt upon each trust.

Do you propose the appointment of those overseers to be with the present commissioners of the roads?—Certainly.

Do you propose any general inspection to be established over the whole system of road-making?—I should think it a public advantage if there was some inspection or controlling power in some quarter or other, to prevent the general surveyors from being improperly appointed; but whether that controlling power should emanate from the government, or the authorities in the county, I am not a judge.

Do you think a controlling power established in the metropolis, to communicate on the subject throughout the kingdom, would be an advantageous establishment?—I think it would be a very profitable and desirable establishment.

Looking to the revenues and to practical advantages?—Looking to the revenues, practical advantages, and to the dissemination of information.

Would you propose their having a power of suspending officers in certain cases?—Certainly, till the pleasure of the commissioners was known; on any gross instance of misconduct or negligence.

Would not you propose they should report occasionally the state and condition of the roads, and also the state of the finances of each trust?—I should think the state of the finances ought to be reported in some way every year, that they might reach parliament, either by counties, or by some means the least expensive and least troublesome; and I think such a report of the finances, annually, would be a great means of preventing misapplication of the public funds; and it would create a comparison between one part of the country and another, that would be useful in checking misconduct.

Then you do not think there is, at present, a sufficient protection of the road revenue of the kingdom against dishonest or ignorant practices?—I think the road revenue is less protected than any other part of the public expenditure; and, though it is very large, it may be considered, I think, almost unprotected, under the present system of law.

Have you any loose guess in your own mind, as to the extent of the revenue throughout the kingdom, raised for the purpose of maintaining roads?—I have been led to guess a million and a quarter a year, as the toll revenue; from the circumstance of there being five-and-twenty thousand miles of turnpike road in England and Wales.

That is an increasing revenue?—It is certainly increasing very

much; I think the revenue has been increased by the increase of travelling, and particularly stage-coaches.

Has not it been the practice to augment the tolls considerably in all recent turnpike acts?—In the three sessions of parliament preceding the present, I think, there were about ninety petitions to parliament for a renewal of acts, and an increase of their tolls, because they were in a state that they could not pay their debts without the assistance of parliament.

Does not the great expense attending the renewal of acts of parliament, contribute very much to restrain a proper improvement of the roads in the kingdom?—The expense of renewing so many acts of parliament, as is occasioned by the great division of trusts in the country, certainly absorbs a very great sum of the road revenue of the kingdom; because those acts are every one of them renewed every twenty-one years, and frequently circumstances oblige the trustees to come oftener to parliament.

Do you happen to know whether there have been any steps taken by the Post-office, with a view to forming some general arrangement with regard to the roads?—I am not acquainted with any. I have had repeated conversations with lord Chichester, the postmaster-general, and he has asked for all the information I could give his lordship; and, of course, I have given the information pretty much in the manner I have had the honour to do to this Committee; and, I believe, his lordship is satisfied that the consolidation of trusts would be very useful: and he has used his influence in the county of Sussex to have nine trusts consolidated, for the express purpose of mutual assistance in providing a general surveyor.

Do you know the result?—I gave the result, and a copy of the resolutions of the county, at the last meeting.

Do you know the result as to the expenditure?—Yes, it goes to that as well as to the amendment of the roads.

Supposing any insuperable difficulty to exist in placing the management of the roads of the kingdom under a board of ma-

nagement, do you not consider that very great advantage would arise from consolidating the different trusts round London, and placing them under an unity of superintendence and regulation?—Certainly so; I think that that would be a measure of the greatest use in the world; and I think that no palliative, no other means whatever can be devised to get the London roads improved, except consolidating the trusts under one head, or one set of commissioners, or some body that shall control the whole; consolidating the roads round London, would be the means probably of great amelioration in the system or manner of mending the roads, and that would serve as an example to other parts of the country, and might be the means of extending improvement in the mode of road-making, and would form a sort of school or example to other parts of the country.

Do you think, upon the same principle that you recommend consolidating trusts round London, it would be advisable that powers should be given to consolidate trusts in different parts of the kingdom?—I should think it very advisable that powers were granted by parliament to such trusts as chose to do it, to consolidate themselves into one body for the purpose of having a better superintendence, or for any other purposes of general improvement; but upon considering the matter very fully, I am of opinion that it would be more profitable that the Legislature should give leave to trusts than that they should make it imperative upon them; it will be absolutely necessary, before any such measure could come into effect, that parliament should not only give this leave, but that they should make the proceedings of the general meeting of those trusts legal, which at present they would not be as the law stands; the nine trusts in Sussex, who have now voluntarily associated together, hold what is considered a general meeting of those trusts; but I by no means think that their proceedings are legal, as the law now stands.

In many cases where the consolidation would be beneficial, do not you consider it would be resisted from local motives?—

Perhaps it might be resisted; it will be unfortunate when that happens to be the case, but when the good effects of it begin to be seen in the country, I think those objections would be got rid of.

Do you believe that the first effects of such consolidation would be a diminution of expense?—I am quite certain of that.

How is that diminution of expense to arise?—By introducing a much better mode of management, it would occasion more regularity in the mode of keeping accounts, it would introduce a diminution of expense materially in horse labour, and in various other things; that I think, upon the whole, the diminution of expense by such regulation would be found very great indeed.

Do not you believe that the present system of maintaining roads is the means of a continued increase of expense in the debt and tolls throughout the kingdom?—I think the debt is increasing very much throughout the kingdom, and that the debt is perhaps greater than gentlemen in parliament are aware of; at present tolls are increasing.

Do you consider that there is a corresponding improvement in the roads, in proportion to the increase of the tolls and debts?—By no means; my belief is, that where the greatest expense is, there the worst management is, or rather, that the worst management produces the greatest expense.

Then, in your opinion, a great improvement might be effected on the roads in general, which might be accompanied in the end by a gradual diminution of debt and tolls?—Certainly, I think so.

Can you give any information as to the total amount of general debt on the roads now existing in England and Wales?—After inquiring by all the means that an unauthorized individual could do in different parts of the country, and ascertaining, as nearly as I could, the amount of debt upon a great number of trusts; I have been inclined to believe that the debt at present amounts to about seven millions in England and Wales.

Are you of opinion that any considerable advantage might be derived in the management of the roads, by a commutation for the statute labour?—Yes; I think very great advantage would be derived by the public, if the statute labour were commuted for money, and that, if it were commuted at a very low rate; if it were one half of the real value of the work, I should think, the roads would be more benefited by it in general through the country.

Is it the general practice in Scotland, under any act of parliament, to commute statute labour for money?—All the acts of parliament I am acquainted with in Scotland have commuted it; one in the county I belong to, commuted it twenty years ago, with very great advantage.

You have mentioned that the commissioners of the Westminster bridge road required you to employ a considerable number of paupers; the Committee wish to know whether it is the general practice, in your observation, to employ paupers upon roads?—I have always found that in every place where the improvement of the roads has been commenced, under any advice given by me, it has been desired very much by the inhabitants that the people unemployed (not, perhaps, paupers that generally receive parish relief, but those people who come to ask for relief, because they cannot get work) should be employed on the road; and it has been very much my wish to gratify that desire by giving them work, not by the day, but by the piece, because that has generally put them off the parishes; the moment they get work to do, by which they can get their bread, and without which they cannot get their bread, they quit the parish.

Is it not the practice, in trusts where you have not been concerned, to employ paupers, or very old labourers?—I have found in all the trusts that have sent to me to take advice, that the labourers have been a great number of them very inefficient men; and the excuse generally given for that is, that those peo-

ple would come to the parish if they were not sent to the roads.

Is the pay of those men proportionably low with their abilities to work?—I have not found that to be the case. I have found that those poor, miserable men, who can do very little, have been getting considerable wages, and in that way a considerable sum has been wasted.

In point of practice, then, the road revenue is made to act as a poor fund?—Precisely so; I think the road revenue has gone to the assistance of the poor in that way.

In your experience have you found that the common mode of employing paupers by day-work, is inefficient both to the improvement of the roads and to the object of relieving the parishes?—It may have the effect of relieving the parishes, but I should think it a very bad mode of mending the roads; inasmuch as these men, when they have got day-wages, will do very little, and for that reason I employ all our men on piece-work; we have two hundred and eighty labourers in the district of Bristol, and they are almost all on piece-work; it is very seldom we employ men by the day. I was directed by the Committee, at their last meeting, to produce some more detailed accounts respecting the Bristol district: in obedience to that order, I have obtained the report made by me at the end of the first and second year of my administration, which I beg to submit to the Committee, together with the resolution of the commissioners thereon.

[*The following Papers were delivered in, and read:*]

EXPENDITURE on the BRISTOL ROADS.

In the year 1815, previous to the alteration of management, there was paid	£.14,285	2	1
An unpaid floating debt of . . .	1,400	0	0
Total expense of 1815, to 25th March 1816	£. 15,685	2	1

Alteration of management, commenced 16th January, 1816.

In 1816, outlay was . . .	£.16,127	5	1
Deduct accounts of 1815 . .	£.1,400		
Paid into 5 per cent. fund, about	340		
	1,740	0	0
Total expense of roads, to March 1817 .	£. 14,387	5	1

In 1817, outlay was . . .	£.15,830	4	11
Of which, permanent improvements cost . . .	£.1,500		
Paid to 5 per cent. fund, about .	200		
Paid for a general survey and plans	340		
Whitchurch Bridge repairs . .	320		
	2,360	0	0
Total expenditure for roads, to 25 March 1818 .	£.13,470	4	11

Bristol Turnpikes.

Report of Mr. John Loudon M'Adam, to a General Meeting of Commissioners, 2d June 1817.

Since I had the honour of reporting to the meeting of commissioners on the 2d of March last, the amendment of the roads has proceeded with success, and at present there are no parts of the roads of the Bristol district in a bad state.

Much has been done in partial improvements, which have altogether amounted to a considerable sum, although not of sufficient magnitude individually to come within the scope of the regulations of the general meeting, that restrain improvements exceeding 50*l.* without special order; several such improvements are still necessary, and some of the small bridges require to be lengthened in the arches, in order to lead the roads to them more commodiously, and to widen the roadway on the bridges.

The statement of the income and expenditure of the year, now made up to the 25th March, presents a very satisfactory result.

In the last year, a sum equal to nearly five times that of the preceding year, has been paid into the 5 per cent. fund.

A floating debt, which did not appear in the printed annual account of last year, but which amounted to about 1,400*l.*, has been paid off.

The balances of treasurer's accounts, which last year showed the trust to be indebted on the whole to the treasurer 356*l.* are now so much on the other side, that your treasurers have on the whole account a balance in hand of 614*l.* and this balance is efficient, because the floating debt is now reduced to the smallest sum possible, under the circumstances of a business so extended.

In addition to which, I have to congratulate the commissioners on a reduction of the principal debt in the sum of 729*l.* 10*s.* 3*d.* and that turnpike tickets, which were at a discount, are now in demand at par.

(Signed) *John Loudon M'Adam.*

8th March 1819.

The foregoing is a true copy from the book of proceedings of the trustees of the Bristol turnpike roads.

Osborne & Ward, Clerks.

BRISTOL TURNPIKES.

Report of Mr. John Loudon M'Adam, to a General Meeting of Commissioners, 1st June 1818.

Bristol Office of Roads, 1st June, 1818.

Since I had the honour to report to the commissioners, in June 1817, the business of the roads has gone on successfully, and they have been kept in invariably good repair under the present system of management, notwithstanding the roads having been tried by all vicissitudes of the most unfavourable seasons ever known.

Several valuable improvements have also been effected in different parts of the district; the very promising state of the

finances having induced the commissioners to employ great part of the savings of their income for that purpose, instead of applying the whole to the liquidation of the principal debt of the trust. This great debt has, however, been diminished nearly 500*l.* while the sum expended on the permanent improvements considerably exceeds 1,500*l.*

				£.	s.	d.
On the 25th March 1818, there was a balance in the hands of each of the treasurers, with exception of the Bitton and Toghill roads; and the balance due to that treasurer has been diminished upon the whole account; there remained in the hands of the treasurers, on the 25th March 1818, the sum of . . .				1,987	14	5
In the hands of the general treasurer, from 5 per cent. fund .	£. 502	5	11			
Due by the Whitchurch road to the 5 per cent. fund, and included in the general debt . .	300	0	0			
				802	5	11
Balance in hand, 25th March 1818 .				£.2,790	0	4

It is very gratifying to report to the commissioners this material amelioration of the funds during the present year, when the income of the trust has suffered a diminution of 425*l.* 5*s.* occasioned probably by the depression of trade throughout the country.

It is to be regretted that the directions of the general meetings respecting the payments to the 5 per cent. fund have not been more punctually obeyed; but without entering into the circumstances of heavy debt and other difficulties, which have hitherto prevented payments from particular treasurers, I beg leave to call the attention of the commissioners to a consideration of the

importance of this fund, and the use to which it may be most advantageously applied.

The fund was instituted for the purpose of giving the general meetings the power of extending aid to any division of the roads of the district that might be in distress. As the favourable state of the funds, arising from the system of management adopted by the commissioners, gives a very reasonable hope that such occasion of distress may never again occur, it may be expedient to consider of the propriety of converting the 5 per cents. into a sinking fund.

By application of such a sum, amounting to about 850*l.* annually, to the gradual extinction of the debt of the trust, the means of continuing several useful and very desirable improvements will be diminished only in a small proportion, and the amendment of the general state of the roads will proceed, without entirely losing sight of the justice due to the creditors, and the desirable object of reducing a debt of such magnitude.

As it may be doubtful whether under the authority of the present act of parliament the trustees may legally apply the 5 cent. fund to the purpose of a sinking fund, the committee appointed to prepare the new act may be instructed to consider of this subject, and also for better securing the due payment of the 5 per cent. fund at stated periods, along with the interest of the debt, to the general treasurer.

I have great pleasure in being able to continue to give a favourable report of the conduct of the sub-surveyors.

(Signed) *John Loudon M'Adam.*

8th March, 1819.

The foregoing is a true copy from the book of proceedings of the trustees of the Bristol turnpike roads.

Osborne & Ward, Clerks.

BRISTOL TURNPIKES.

At a Meeting of the Trustees for the care of the several roads round the city of Bristol, holden on 7th December 1818, at the Guildhall in Bristol.

THOMAS DANIEL, Esq. in the Chair.

It appearing that under the triennial appointment of Mr. M'Adam, his office of general surveyor will cease on the 16th day of January next;—

Ordered unanimously, That he be again appointed to that office for a further term of three years, at the same salary.

Resolved unanimously, That the thanks of this meeting be given to Mr. M'Adam for the zeal and ability with which he has executed the very arduous duties of his office, from which it appears to this meeting that the most important advantages have resulted to the roads under his care.

8th March 1819.

The foregoing is a true copy from the book of proceedings of the trustees of the Bristol turnpike roads.

Osborne & Ward, Clerks.

Does any part of that saving which is stated to have taken place on those roads, arise from an increase of revenue?—There has been a small increase of revenue, but whether arising from tolls or a better collection of the statute labour, I cannot take upon me to say; but that increase of revenue must be deducted from the saving of 2,700*l.*, which appears in the treasurer's hands.

Jovis, 11° *die Martii*, 1819.

John Loudon M'Adam, Esquire, called in; and Examined.

IS there any part of your former evidence upon which you wish to give any further explanation to the Committee?—In consequence of the surprise and doubt expressed by some members of this honourable Committee, on that part of my evidence respecting the carrying a road over a morass in Somersetshire, and the proportions of the materials used upon that, and the part of the road with a rocky foundation, which I stated from memory, I thought it proper to write down to the treasurer of that road, to request the favour of him to send for the surveyor, and know the facts exactly from him. The treasurer, Mr. Phippen, who is a magistrate, sent a certificate, signed by the surveyor. There was a certificate, also, signed by Mr. Phippen; and with it there was a letter from Mr. Phippen, of explanation; both of which I wish to put in.

[*The papers put in were as follow:*]

"I do certify that that part of the sixteen miles of the Bristol turnpike road under my care, from Cross, over the marsh lands, towards Bridgewater, is now in the best state I ever knew it, which is wholly owing to having the very large stones laid at the foundation when the road was first made more than fifty years since, lifted and beaten very small. The general strength of the road is from seven inches to nine; and five tons of stones, I have always considered for the repairs of this part of the road equal to seven on the other part over the hills.

(Signed) "*Edward Whitting*, Surveyor."

" I, Robert Phippen, Esq. one of His Majesty's justices of the peace for the county of Somerset, and treasurer on the road mentioned in the above certificate, do hereby certify and declare, that the contents are true to the best of my knowledge and belief; and the road in question has been under my constant inspection for five years past; and the surveyor, Edward Whitting, is a person well known to me, and worthy of credit.

" Dated March 9th, 1819."

" Letter from Robert Phippen, Esq. to John Loudon M'Adam, Esq. No. 9, Northumberland-street, Strand, London.

" Dear Sir,

" There cannot, in my opinion, be any necessity to lay the foundation of a road on any ground, even the most soft and peaty, with large stones; daily observation tells me, that this is a great waste of time, materials, and money. I have had, for these five or six years past, a great deal of experience in seeing roads made, one in particular, over a very soft peat-bog, by Wedmore and Glastonbury, in this county. At the time this new line of road was proposed to be made, a great difference of opinion existed as to its practicability, and the method to be pursued to accomplish it. Some of the parties were for laying the whole of the road over the bog with brush-wood, on which were to be put large flat stones, and on those smaller ones. We who were the other party, insisted that a more simple, less expensive, and more permanent method was to make it with stones alone, broken very small. We, at last, prevailed, and the system succeeded even beyond our most sanguine expectations; for this part of the road has stood uncommonly well, though the travelling on it has been very great, and with heavy carriages, and the little repairs wanted have been done

at an inconsiderable expense, compared to the other part of the road made on hard ground over the hills.

" I remain, dear Sir, your's truly,

" *Rob. Phippen.*"

" Badgworth Court, near Axbridge,
March 9th, 1819.

I wish, in reference to the opinion I gave with respect to the statute labour, to state, that I have to transact with sixty-nine parishes, respecting their statute labour, in the counties of Somerset and Gloucester; and that it is in consequence of these transactions, I gave the opinion to the Committee that I had the honour to submit.

What proportion of the statute duty, by pecuniary payments, instead of the mode at present adopted, do you conceive might be saved?—I think, if one third of the present nominal value of the statute labour was to be regularly paid into the hands of the treasurer, that it would be more available to the public roads, than the present manner in which the work is done, and certainly less onerous to the agriculture of the country.

James M'Adam, Esq. called in; and Examined.

YOU are the son of the last witness?—I am.

Have you been employed as a general surveyor upon the turnpike roads?—I have.

Upon what roads have you been employed?—Upon the Epsom and Ewell turnpike roads of twenty-one miles; upon the Reading road of six miles; upon the eastern division of the Egham road, seven miles and a half; on the western division of the Egham road, eight miles and a half; on the Cheshunt turnpike roads, of eighteen miles; upon the Wades-mill turnpike trust of twenty-nine miles: on the old North road, or Royston road, of fifteen miles; upon the Huntingdon road of ten miles; and on the road from Huntingdon to

Somersham of ten miles; being together one hundred and twenty-five miles.

How long have you been appointed to them?—My first appointment was in December 1817.

Had you been previously in the habits of making the improvement of turnpike roads your study?—I had at Bristol, under my father's tuition.

The information you have acquired, I presume, then, has been entirely under your father's system?—Yes, upon my father's principles of making roads.

And those plans which you have adopted, have been entirely conformable to the evidence which he has given before this Committee?—Entirely conformable to those principles which my father has stated in his evidence before this Committee.

Can you give the Committee any information with regard to the revenues of the different roads under your management?—The gross revenue of the trusts I have mentioned, of which I am general surveyor, is about 19,550*l.* per annum.

Please to state to the Committee, the state of repair in which these roads were when they first came under your management?—The roads in general were in a very loose, rough, and heavy state, much overloaded with materials, the watercourses much stopped up, and the roads in general in a very bad state.

What improvements have taken place upon them since your undertaking the care of them?—The Epsom and Ewell roads were put into a perfect state of repair during the last spring and summer; the Reading road has also been put into a perfect state of repair during the last summer; and the Cheshunt turnpike roads have been put into a good state of repair, notwithstanding that the improvements commenced in October, and have been carried on through the whole winter: the improvement is proceeding rapidly in the other districts; but the three roads I have mentioned, are the only

trusts that are brought into a perfect state of repair. I venture to speak freely and with great confidence, of the good state of repair of these three trusts; for the reason, that no credit whatever is attached to me, except what may be considered due by the careful attention and zealous execution of my father's commands. The merits of the improvements are wholly his own.

Can you state to the Committee the expense with which these improvements have been accompanied?—The expense upon the Epsom roads amounted to 1,929*l.* 8*s.* 1*d.* in the year 1818; that is the only trust upon which I am enabled to state the twelvemonth's expenditure.

In what proportion has the expenditure been divided between the labour of men, women, and children, and the price of cartage and of materials?—I have paid for labour upon the Epsom roads, 1,146*l.* 1*s.* 2*d.*; for materials, 98*l.* 10*s.*; for cartage, 227*l.* 16*s.*; for tradesmen's bills, 342*l.* 0*s.* 11*d.*; for land to widen the roads, 115*l.*; which makes up the expenditure 1,929*l.* 8*s.* 1*d.* I beg here to state, that I did not avail myself of any statute duty upon the Epsom and Ewell roads.

Can you state to the Committee the expenditure upon these roads, in the years preceding your having the charge of them?—I can; in the years 1815, 1816, and 1817, which are the three preceding years to my having the charge of these roads. In the year 1815, there was paid for labour, 379*l.* 14*s.*; for cartage, 1,019*l.* 14*s.*; for gravel, 486*l.* 15*s.* 5*d.*; for tradesmen's bills, 178*l.* 6*s.* 3*d.*; making a total of 2,064*l.* 9*s.* 5*d.* In the year 1816, there was paid for labour 340*l.* 16*s.*; for cartage, 1070*l.* 7*s.* 6*d.*; for gravel, 563*l.* 1*s.* 10*d.*; for tradesmen's bills, 382*l.* 4*s.* 5*d.* making a total of 2,375*l.* 19*s.* 9*d.* In the year 1817, there was paid for labour, 339*l.* 16*s.*; for cartage, 1,103*l.* 16*s.* 3*d.*; for gravel, 551*l.*; for tradesmen's bills, 681*l.* 6*s.* 1*d.*; making a total of 2,675*l.* 18*s.* 4*d.*; independent of the statute duty

upon the several parishes, which were called forth by the former surveyor.

Do you know the value of that statute duty?—Not having had occasion to call it forth, I am unable precisely to answer the question; but the parishes are wealthy, and the statute labour must form a very considerable amount.

I presume the comparative smallness of the expense which you incurred for materials must have arisen from making use of the old materials upon the road, by lifting them according to the plan which your father has described?—That was the case.

In what state did you find the executive department of these roads when you took charge of them?—I found at Epsom a person as surveyor, who had been an underwriter at Lloyd's Coffee-house, at a salary, as I am informed, of sixty pounds per annum, and who was permitted to keep the carts and horses, and do the cartage for the trust. At Reading, I found an elderly gentleman as the surveyor, who was also one of the commissioners, at a salary of twenty or thirty pounds per annum. I found at Cheshunt three surveyors, the trust being divided into three districts. One of the surveyors was an infirm old man, another a carpenter, and another a coal-merchant. I found on the Wades-mill trust three surveyors also, and the trust divided into three districts; one of these surveyors was a very old man, another a publican at Buckland, and the other a baker at Backway, with a salary of fourteen shillings a week each. I found on the Royston road a publican as surveyor there; and I found at Huntingdon a bedridden old man who had not been out of the house for several months, and who had been allowed by the commissioners to apply to a carpenter in the town for assistance, and to whom the commissioners allowed twenty pounds per annum; this person, who accompanied me in the survey of the roads, stated, that he

could give but little attention to the management of the road, the salary being so small; and the state of those roads bore evidence to the truth of his assertion.

Without entering into individual cases, do you consider that it was possible, from the nature of the circumstances and engagements of these parties, that they could give that attention to the roads which their improvement required?—I do not consider it was at all likely that they would.

What arrangements did you make in the executive department of these roads after you took the charge of them?—With the permission of the trustees, I appointed upon each trust an active sub-surveyor, whom I required to keep a horse, and to have no other occupation whatever.

Can you state to the Committee the expense of employing such sub-surveyors?—The salary of the sub-surveyors in general is one hundred guineas a year; and where the revenues of the trust have been small, as in the case of the Royston roads and the Huntingdon roads, I have made one surveyor do the duty of both the trusts, in order that that expense might be divided.

What emoluments have you yourself derived from your employment upon these trusts?—I am unable to state the precise amount to the Committee; for the reason that I have in every instance requested of the trustees that that consideration might be deferred for at least a twelvemonth after I was honoured with the charge of the roads; Epsom is therefore the only road upon which that period has elapsed; and with the permission of the Committee, I will read the resolution entered upon the ledger of the Epsom roads upon that subject.

21st December, 1818.

We have examined the above accounts of Mr. M'Adam, the surveyor, from its commencement to this date, and find

that the sum of 75*l.* 6*s.* 1*d.* is due to Mr. M'Adam, by the trust, say - - - - - - - - £.75 6 1.

But as no allowance has been made to the surveyor for his management, and as that management has given great satisfaction to the trustees, it was resolved to give the surveyor, to cover all charges, and for his trouble, it being distinctly understood for this year only, the sum of one hundred and fifty guineas - 157 10—

£.232 16 1

Which sum of 232*l.* 16*s.* 1*d.* the treasurer will be pleased to pay to Mr. M'Adam.

(Signed) *T. Reid, Thomas Halliday, Edward Arekbold, William Dowdeswell, John Webb, J. M. Cripps." Thomas Calverley,*

With permission of the Committeee I will relate what I stated to the trustees, upon those resolutions being read to me; that I considered that sum as extremely liberal, and quite sufficient for one small trust to give a general surveyor, and were Epsom one trust in a district, such a sum would be quite sufficient for their proportion of the salary of a general surveyor; but standing alone, and divided from all other trusts of which I had the management, and separated also by the London roads, the necessity of my father's travelling from Bristol and residing some time at Epsom, and of so much being required to be done the first year in a new trust, that sum did no more than repay the actual expenses incurred. It will be obvious to the Committee that such a trust as Reading, consisting of six miles only, distant from Bristol eighty miles, and from London forty miles, and anticipating an equal liberality on the part of the commis-

sioners there, no sum such a trust could be justified in giving to a general surveyor could repay even a moiety of the expense of superintendance; the reward for my services, then, must be looked for in the convincing proof that my father's principles of road-making are, if possible, more applicable, and more beneficial in a trust where the materials are very bad than where they are good: my only object in troubling the Committee with these observations, is to show that unless a district of roads are united, the expense of a general superintendance would not be paid by any salary such trust could be justified in giving.

Can you state to the Committee the nature of the materials which you have employed in the different roads under your care?—At Epsom there are flints; at Reading a very small foul gravel, with a thick adhesive loam attached; at Waltham Cross, on the Cheshunt roads, small foul gravel; towards Ware, flints; on the Wades-mill trust, flints; on the Royston trust, flint, gravel, and blue permet stone; at Huntingdon, flint, and gravel; Egham, flint and gravel.

Is there any particular method which you have employed out of the common practice, for making use of these materials?—I have bestowed great labour, care and attention in the preparation of these materials in the pits, and in their separation previous to their being brought upon the roads; and also much labour and care for a length of time after their being laid upon the road, until it became perfectly smooth, hard and level.

Can you state to the Committee the probable future expense of keeping these roads in repair, after they have once been put into good order, as compared with the annual outgoings under the old management?—I am of opinion that the expense of maintaining these roads in good condition will be considerably less than the former expenditure; for the reason, that the better a road is, the less the wear; and

that there will be a less quantity of materials required, when properly prepared, than were formerly used, when they were brought to the road in a very foul and improper state.

Can you state generally, whether the proportion of labour, materials and cartage that you have described upon the Epsom trust, agrees with the same proportion upon the other roads under your management?—On some of the other roads, the proportion of labour to cartage will be found greater than upon the Epsom road. At Cheshunt, in five months, during which the roads have been put into good repair, I have expended the sum of 800*l.* forty of which alone was paid for cartage. Upon the Wades-mill trust, out of 600*l.* expended, not a sixpence was paid for cartage. Upon the Royston roads, where I have spent 500*l.* not any of it was paid for cartage. Upon the Huntingdon roads, I have spent 20*l.* a week, the whole of which has been paid in labour. At Reading, during eight months, 500*l.* were laid out, 400*l.* of which were paid for labour.

Is it your opinion, that the proportion of labour, wages, and cartage, is likely to continue the same, in the future reparation of the roads?—I am of opinion they will; because there will be an increase of labour, in the preparation of the materials, previous to their being brought to the road; and also in the formation of the road after they are laid on. By a more careful and proper preparation of the materials, a much less quantity will be required to uphold the roads than formerly; I am, therefore, of opinion, that the proportion of labour to cartage will continue the same.

It appears, by your answer to a former question, that the expense of cartage has been much diminished, owing to your making use of the materials of the old road; will not the proportionate expense of cartage for future years be increased in consequence of your no longer having the resource of breaking up the roads, but being obliged to repair

them with fresh materials?—In some degree it certainly would.

In what way is the statute labour at present performed upon these roads?—Upon two of the trusts only, the Royston road and the Huntingdon road, I have had occasion to avail myself of any statute labour; the fund upon the other trusts being more than sufficient to uphold the roads without having recourse to statute labour. Upon these two trusts I have derived some small advantage from statute labour.

Colonel *Charles Brown*, called in; and Examined.

ARE you one of the commissioners of the turnpike road upon the Cheshunt trust?—I am.

How long have you acted?—Several years, eight or ten years.

Be kind enough to explain to the Committee any recent improvements which have taken place in the management and repairs of the roads within that trust?—Since the new method has been adopted by Mr. M'Adam, a very evident advantage has arisen to the roads; they are now extremely good, and were formerly very indifferent; I therefore attribute it solely to the present mode adopted by Mr. M'Adam for nothing can be better than the roads are at present.

Can you state to the Committee, whether the improvement has taken place with an increase or a diminution of the expense?—I believe at about one-third less; At least I understand that it was taken at about one-third less.

Has there been any increase upon the tolls upon these roads?—Not since Mr. M'Adam has had any thing to do with them. I have every reason to suppose there will be a diminution, in consequence of the good state of the roads.

Having heard Mr. M'Adam's evidence, can you give the Committee any further information with regard to the means by which these improvements have been effected?—I con-

ceive that the mode of Mr. M'Adam has been the means of making the roads so much better, that it is only wonderful when we see it now, that it has not taken place sooner, being founded upon the best principle possible.

Can you state whether these improvements have taken place by the use of any new materials, or by a better application of the existing materials?—By the better application of the existing materials, certainly.

Have you found this improved system attended with any advantages, in regard to the employment of the poor within those parishes?—With regard to the parish where I live, and where my property is situated, I have seen considerable improvement, since we have had the opportunity of sending our poor to be employed by Mr. M'Adam, who has most readily employed every one we have sent; and I can state now, that we have not a man unemployed that I know of.

Ezekiel Harman, Esquire, called in and Examined.

YOU are a commissioner of the turnpike road upon the Cheshunt trust?—I am.

Having heard the evidence of the last witness; can you, upon your own knowledge, confirm the testimony that he has given with regard to improvement of the roads within your trust under Mr. M'Adam's inspection, and the advantages derived therefrom?—I can, certainly. It is a matter of surprise to me, that so material an alteration has been already made in the roads, the advantages of which are obvious to every one travelling the road; and, as an additional proof, the coachmen who are in the habit of driving that road have confirmed this statement. I have witnessed also a similar improvement in the Epsom road, where the forward state of the improvement shows an additional proof of the advantages derived from this system.

Thomas Bridgeman, Esquire, called in; and Examined.

ARE you a commissioner upon the Cheshunt trust?—I am.

Having heard the evidence of the two last witnesses does your judgment in all respects confirm the testimony which they have given, in regard to the improvement which has taken place upon your roads, and the advantages derived from them?—Most assuredly. I have witnessed these roads for more than twenty years, in a variety of forms as a commissioner. I have observed the failure of two or three different sets of coachmen and coach concerns down below, all of whom are now saying, that if this system continues they shall require a horse less. All these parties were originally much prejudiced against the new system.

John Martin Cripps, Esquire, called in; and Examined.

YOU are a magistrate of the county of Surrey, and commissioner of the roads upon the Epsom trust?—I am.

Can you inform the Committee what was the state of the roads within your trust, previous to the year 1818?—They were very bad, having no attention paid to the formation of the road; having the water, in many places, going over the road; and great inattention paid to the breaking of the materials, and to the expense attending the carting of them.

At what time did you commence the alteration in the system of management?—At the latter end of December 1817, when the roads were put under the superintendance of Mr. M'Adam, senior, and when his son commenced the management.

What alterations have since taken place in the state of the roads?—By a better formation of the road; the materials

being properly broken; and the water carried under the road by trunks, or drains, with proper gratings.

Referring to the particulars of the expenditure given by Mr. M'Adam, jun. in his evidence this day, can you confirm the accuracy of those accounts?—Yes; and I can explain that the items for tradesmen's bills include the wharfing and repairs of Bridges in each year; I can add, that the statute labour for 1815, 1816, and 1817, amounting to one hundred pounds each year, which Mr. M'Adam has not availed himself of in their improvements.

Has the system of management pursued by Mr. M'Adam proved the means of giving employment to labourers in the district, and thereby lessening the poor's rates?—Very much so; and they have occasionally employed from twenty to thirty persons, stout able-bodied men, who otherwise would have been obliged to have been supported out of the parish rates.

Have you in consequence had any persons who were able to work who have been out of employ?—Between twenty and thirty persons have been employed for the last three months in breaking flints, and in repairing and improving the roads, who otherwise must have come upon the poor's rates; and all the persons who have been enabled to work have found employment in consequence of this improvement; that has been the means of greatly relieving our poor's rates.

Has the same system been extended to the private roads in that district?—It has been adopted in some of the private roads of that district, and with the same beneficial effects.

Can you state any particulars with regard to the necessity there has been for carting additional materials for these roads?—At present Mr. M'Adam having lifted the roads, has found more than sufficient material for the support of those roads.

What have been the materials that have been used?—The materials that have been used are flints chiefly.

During the state of improvement of these roads, have the tolls been increased or reduced within your trust?—At our last meeting, we agreed, that at the next letting, the tolls should be reduced from May next, for the benefit of agriculture in general; and that where two shillings and eightpence is now paid, they will have now to pay one shilling; that with relation to the agricultural interest, will be a reduction of twenty five pounds per mile.

Within your own personal observation, have you known any other instance in which a road has been formed upon the same principles as those adopted by Mr. M'Adam?—I had an opportunity of observing in Sweden that the roads were more beautiful than any I ever beheld; they are formed in the same manner as by Mr. M'Adam, the materials broken extremely small. The material is the best in the world, as it is rocks of Granite; and so well do they understand the necessity of breaking them small, that you never behold throughout Sweden, a fragment of granite larger than the size of a walnut, for the purposes of the roads.

What is the shape of these roads?—To the eye they appear perfectly flat; but upon trial by the spirit level, there is a slight degree of convexity.

William Dowdeswell, Esquire, called in; and Examined.

YOU are a commissioner upon the Epsom trust?—I am.

How long have you been a commissioner?—About four or five years.

Have you had any opportunity of observing the comparative state of the roads since they were put under the care of Mr. M'Adam, compared with that in which they were

before?—They were very bad when first put under Mr. M'Adam's care; they are now, I think, very good.

Do you attribute this to the improved system of management?—Totally.

Can you confirm the evidence that has been already given relative to the expenses of repairing the roads previously to that time and since?—From the statement made to me by the former surveyor, and from Mr. M'Adam's statement, I believe the statements delivered in to you are perfectly correct. Considering the advantage which the public has derived from Mr. M'Adam's system, I have adopted the same upon the parish roads. I offered myself to the parish as their surveyor, for the purpose of carrying that system into execution. I have found employment for all persons who wanted employment upon the parish roads, assisted occasionally by persons going to the public roads under Mr. M'Adam.

How long have you adopted this system upon the private roads?—Ever since October last.

From that period the whole of the poor have been employed upon the parish roads?—From that period the whole of the poor that wanted employment, have been employed upon the parish roads, or upon the public roads under Mr. M'Adam.

Have those persons been employed by you, by piece-work or by day-work?—The roads were in such a state, and as I wanted knowledge to employ by piece-work, I have been compelled to employ them by day-work.

From your experience are you of opinion that these private roads, made upon the new system which has been adopted, can be kept in good repair at a less expense than they formerly cost in their bad state?—At a very considerable less expense than formerly.

Martis, 23° die Martii, 1819.

Mr. *Benjamin Farey,* called in; and Examined.

YOU are, I believe, the surveyor of the Whitechapel road?—I am.

How long have you been in that office?—Nine years.

In what situation did you find the road, at the time of your undertaking the management?—I found the Whitechapel road in a dreadful state, partly from the neglect of the surveyor, in laying on foul and improper materials. In the autumn of 1809, it was almost impassable.

Gravel is the only material you have in that neighbourhood?—Gravel is the only material we find, on or near the spot.

Is the traffic upon the Whitechapel road so great as to render it impossible to preserve it in good order with the present materials?—It is impossible to preserve it in good order at all times, with the present materials; it is past the art of man.

Do you consider the traffic upon that road, as greater than upon any other road out of London?—I believe it is a heavier traffic; there are not so many light carriages, as on some other roads.

What species of carriages do you consider do the most injury to your road?—The carriages that do the most injury, are those with the widest wheels.

In what way do you consider that they injure the road?—By their great weights destroying the materials.

Are the carriages you allude to, exempt from the payment of tolls?—They pay much less tolls. The pressure, or crushing of materials by the wide wheels, is owing to the wheels not running flat.

Being of a conical shape?—Being of a barrelled and

conical shape, and the middle tire projecting above the others, with rough nails.

Do you consider, that if those wheels were made of a cylindrical or flat shape, it would be good policy to grant them any exemption from tolls?—They would be less injurious for being cylindrical; but whenever the road was at all out of the level, and the weight came on one edge of the wheel, the road would be destroyed there.

Upon the whole, is it your opinion that there are any circumstances which justify an exemption from toll, on account of the breadth of the wheels?—I do not see any at all, for I think they are injurious in every sense, on account of the great weights they carry.

Do you consider that injury is done to the roads, in consequence of the use of single shafts in waggons?—Very great.

In what way?—In consequence of single shafts, the horses follow in one track, in the centre of the carriage; and the wheels also follow each other in other tracks, and cut ruts: if there were double shafts, they would naturally avoid former wheel-tracks, which would be less injurious to the road.

Do you consider it therefore desirable to give encouragement to double shafts?—I do.

Do you consider the watering of that road in any way injurious?—I consider that watering that road in summer, is very injurious.

In what respect?—The water separates the stones, owing to the softening of the loam, and makes the road spongy and loose.

At what periods do you consider it injurious to water the road for laying the dust?—Before May and after August.

Have you not a practice of sometimes watering in winter, when there is no dust?—After the most careful sifting of the

gravel, a small quantity of loamy dirt will unavoidably still adhere to the stones, and this loam, together with a glutinous matter which accumulates in the summer from the dung and urine of the cattle (which accumulation the summer watering has a tendency to increase) occasions the wheels to stick to the materials, in certain states of the road, in spring and autumn, when it is between wet and dry, particularly in heavy foggy weather, and after a frost; by which sticking of the wheels, the Whitechapel road is often, in a short time, dreadfully torn and loosened up; and it is for remedying this evil, that I have, for more than eight years past, occasionally watered the road in winter. As soon as the sticking and tearing up of the materials is observed to have commenced, several water-carts are employed upon these parts of the road, to wet the loamy and glutinous matters so much, that they will no longer adhere to the tire of the wheels, and to allow the wheels and feet of the horses to force down and again fasten the gravel stones; the traffic, in the course of four to twenty-four hours after watering, forms such a sludge on the surface, as can be easily raked off by wooden scrapers, which is performed as quickly as possible; after which the road is hard and smooth, the advantages of this practice of occasional winter watering have been great; and it might, I am of opinion, be adopted with like advantages on the other entrances into London, or wherever else the traffic is great, and the gravel stones are at times observed to be torn up by the sticking of the wheels.

In what state of the road are you in the habit of laying on fresh materials?—I prefer laying on materials immediately after the road has had a scraping, in consequence of there being upon the surface of the road a small quantity of dirty matter and broken gravel, which then forms a sort of cement for the gravel to fix in.

You consider it advantageous to lay on the materials when the road is wet?—I do, because the gravel adheres closer.

Considering the very great traffic upon the Whitechapel road, is it your opinion that it would be advantageous to pave any part of that road?—I think it would be desirable to pave it, within some feet of the footpath more particularly.

What breadth from the sides of that road would you consider it desirable to have paved?—About eleven or twelve feet from the footpath.

You would consider it a desirable plan to pave the sides of that road in preference to the centre?—Certainly.

For what reasons?—If the centre was paved, the light carriages would be very much annoyed; when the gravel road was good on the sides, the heavy carriages would go there, and the light carriages would be driven on the stones from the sides again; if the centre was paved the carters would be obliged to walk on that road to manage their horses, and would be considerably annoyed by carriages, horsemen, &c. passing: but if the sides of that road were paved, the carters would be enabled to walk on the footpath and to manage their horses without annoyance.

What is the shape of road which, from your experience, you would give the preference to?—I would have the road barrelled, and made so as that it would convey off the water in the severe weather in winter, when the roads are generally bad.

Which do you give the preference to, a road with a flat surface, or one that gradually declines from the centre?—I think a road which gradually declines from the centre is by far the most preferable, decidedly so.

What is the degree of the declivity or fall which you would recommend as the most desirable?—I have paid particular attention to the Whitechapel road, where it is of the width of 55 feet, and the fall from the centre to the sides is

12 inches; but to attain this shape, when the road is worn down, when first covered with gravel, there should be a fall not exceeding from 16 to 18 inches from the centre to the sides. [*The witness delivered in a cross section of the road.*]

Is it your opinion that any parliamentary regulation with regard to stage coaches is necessary for preventing injury to the road?—None.

You think it desirable that they should remain as at present?—Yes.

What is the state of the Whitechapel road now, as compared with what it was some years ago?—During the greater part of the year, it is now one of the most pleasant roads out of London to travel upon; but from the gravel being small and brittle, it is soon worn down, by the great number of heavy weights passing on it. With the small gravel we have in the neighbourhood of Whitechapel, the road at times breaks up, and becomes in a bad state; but by the application of water, to stop the sticking of the wheels, and separate the sludge, in two days they are found in a good state again.

Have you any other suggestion to make to the Committee for the improvement of that road, or of roads in general?—On that road, very great improvement might be made, in not allowing the wide wheels to pass by paying so little toll, or to carry so great weights as at present; if the narrow-wheeled waggons were to use double shafts, they would be less injurious to the roads: even with narrow-wheeled carts, if the two fore-horses were double, the shafts not being in their track, it would be less injurious to the roads.

John Farey, Esquire, called in; and Examined.

WHAT is your profession?—I am a mineral surveyor and engineer.

Have you turned your attention to the state of the roads in the different districts of the kingdom?—I have, very particularly.

Can you furnish the Committee with any information with regard to the state of those roads, as compared with former years?—I can; I have particularly attended to that subject more especially in the time of the late duke of Bedford, for whom I was an agent. I have since been employed in nearly every part of England and Wales, and also in Scotland: and I have statements by me of the various observations I have made.

You have been employed under the late duke of Bedford, in the improvement of the roads in the neighbourhood of Woburn?—In the management of his roads in Bedfordshire, and of all his rural works.

Describe what improvement of the main road has taken place under your direction, in Woburn?—The whole of the line of the road through Woburn, except about three hundred yards in different places, is on a very strong alluvial clay: the road passes over naked sand, only for three hundred yards; this road had been rendered so sandy and so bad, entirely by bringing soft sand-stone out of Buckinghamshire, at three miles carriage, upon the average, in Woburn, and some of that stone was brought almost to the end of Hockliff Town, where the best gravel abounds. It appeared, from the remains of a number of gravel-pits, that there had been formerly a great deal of gravel dug in Woburn; this circumstance I mentioned to the duke of Bedford, and he desired search to be made; and it was ascertained that Woburn might furnish gravel enough, adequate to any purpose. In consequence of which, his Grace directed, when the labourers were much in want of employment, that the poor persons should be employed in preparing a great quantity of gravel for the purposes of this

turnpike road. I undertook to direct the taking of this gravel out, and to level the siftings and dirt in a uniform manner, and lay all the soil again upon the top; by which means the land was in no degree injured, but, in fact, considerably benefited, by being loosened to that depth. A great many hundreds of cubic yards of clean-sifted and picked gravel were prepared in numerous square stacks, and the trustees at a meeting, or else their clerk, were informed, that this gravel his Grace offered to the road at the mere cost of labour, without any thing for the gravel, or the temporary damage to the occupiers of the land. After a long time of hesitation, the trustees or their clerk returned an answer, that they did not like that mode, alleging that their surveyor ought to be allowed to dig materials where and how he liked, and they would not have this gravel: it lay there, some of it for two or three years, upon the land. In that time a number of private roads were making of his Grace's, and a good deal of it was used on these. The main road became progressively worse and worse, and the post-office caused the parish to be indicted. I was then surveyor, and made an application to the trustees, stating the circumstances the road was under: that road-trust is thirteen miles in length, two of which, or rather more, are in the parish of Woburn; there is a toll-gate in the parish, which the inhabitants are liable to all the toll of; some of them, even in going and returning to and from their fields: the trustees had exacted very strictly *the half* of the statute duty, although the parish had, I think, eleven miles of private roads to maintain. I mention this circumstance to show there was no default on the part of the parish; and it was afterwards proved, that they had done their duty; the trustees merely laughed at the application, and said, that they had nothing to do with it: we must repair the road, and till we did so, they would not lay out a farthing upon

our road. It happened, very fortunately for the parish of Woburn, that their act was very nearly out, and they applied for a new one; the parish opposed it, stating, that the trustees had misapplied the tolls, and praying, that the part of the road, through Woburn, should be taken out of their management; the act accordingly directed, that two-thirteenths of the tolls should be paid over to the parish surveyors of Woburn, and the trustees were not to call for any statute-duty, or interfere in the management of this part of the road; in consequence of this, the gravel mentioned, which remained, and great quantities dug on purpose, was used upon the road, in a sufficient quantity at once, so as to admit of its settling down together; for it wanted liming nine inches thick, or more, and the road has since been perfectly good.

Jovis, 25° die Martii, 1819.

John Farey, Esquire, called in; and Examined,

IN effecting the improvement of the Woburn road, did you make use of any particular mode of applying the gravel? —The gravel, before the time of using it, had been very clean sifted, and separated from the dirt and sand; the great stones had been picked out, and such of the flints which were of a long and irregular shape, in order that they might be broken. After laying the gravel upon the road men were daily employed to rake the gravel into the ruts, and, at the same time, to carefully pick off the surface any stones that were either soft or improperly shaped, like long flints, or too large.

What is your opinion, in regard to the form the most pre-

ferable for turnpike roads?—A small convexity in the middle.

Will you state the fall, in any given width of road, that you would prefer?—Referring to my brother, Mr. Benjamin Farey's evidence, I agree with him in wishing that the section which he produced, might be received by the Committee, as an answer to this question.

Is there any particular circumstance, in the formation of roads, more particularly applicable to the immediate neighbourhood of London?—In the neighbourhood of London, and of several other large towns, the materials that are to be readily procured, are of too tender and brittle a nature to endure the wear of the heavy carriages; I therefore am of opinion, that it would be proper to pave the sides of all the principal entrances into London; but not the middle, as has been done on the Commercial road and Borough Stones'-end road. My reasons for preferring the sides being paved are, that it is next to impossible to compel the carters to keep upon the pavement in the middle of the road, in too many instances; the fear of damage, from the swift going carriages, occasions them, either to draw their carts close to the sides, and walk upon the footpaths, or what is worse to leave their horses in the middle, beyond a train of carriages. The sides being paved, would enable one of those trains of carriages to enter London on one side of the road, and go out of it on the other, without many occasions to turn out of their tracks: which keeping nearly to the same tracks, upon a well-paved road, would not be prejudicial; but on a road formed of gravel is entirely ruinous.

Do you consider that the plan of rolling the roads in the neighbourhood of London might be advantageously introduced?—The centre of the roads I should recommend to remain covered with clean-sifted and picked gravel, having

as many as possible of its large, roundish and smooth stones broken by means of a hammer before the time of laying it on the road, and that an heavy iron roller, of from four to five feet diameter, and not less, might be advantageously used in the first settling down of this gravel; a small roller, such as I believe to have been tried in the neighbourhood of London, very heavily loaded on its top, might have a tendency to force the loose gravel before it so as not easily to be drawn or to mount on to the gravel driven before it without crushing the flints. I will add, I am of opinion, that a roller could not be beneficially used upon a road at any other times but after new coating it with gravel, or after a frost or the sticking of materials to the wheels may have loosened up the materials.

Do you consider that the present regulations in regard to exemptions of tolls to waggons with broad wheels, are justified by sound policy?—In my opinion, those exemptions have wholly originated in mistaken principles, and that no wheels wider than about six inches are now, in fact, used upon the roads, owing to the general and gross deceptions which the waggoners practise as to the breadth of surface that their wheels roll on; and that if by any more efficient regulations, the users of broad wheels were compelled to roll the breadths of surface, which the laws contemplate, all such wheels would be immediately disused, from the great additional force of draught which broad wheels occasion during the average state of all the roads.

Are you of opinion that any regulation by statute, for substituting cylindrical for conical wheels, would remedy that evil, or justify an exemption from toll?—As far as I have observed, there are no conical wheels in use: all the wheels are rounding or barrelled, and it is comparatively an immaterial circumstance whether they approach the form of a cone or a cylinder, while they remain so rounding or barrelled,

because their enormous loads roll on a very small portion of the surface of all those broad wheels. I think that six-inch cylindrical wheels, or under, are the most practicable and useful, provided the projecting nails are most rigidly prohibited, which I believe can never be done but by a penalty per nail upon the wheelers who put in those nails, and upon the drivers of the carriages who used such roughly-nailed wheels.

Are you of opinion that the penalties now fixed by law upon over-weights are regulated upon good principles?—I consider the whole system as to penalties upon over-weights generally bad; the present regulations seem to me framed upon mistaken principles, and are the source of very great impositions.

In what manner might the penalties and tolls upon carts and waggons be best fixed?—It is not practicable to very simply or in this way state any one scale that would be generally applicable for each breadth of wheels: below six inches, there should be a rate fixed, which would apply to ordinary or gate-tolls, and at the weighing machines additional tolls, which I will call machine-tolls, should be levied upon all carriages which exceeded the weight, to be regulated in an increasing scale for each breadth of wheel, so as very greatly to discourage, but not ruinously to prohibit the occasional carrying of large weights upon any wheels.

You are not, then, of opinion that it would be right to do away the regulations altogether in respect to the weights, and apportion the tolls only to the number of horses?—By no means.

Are you acquainted with any particular weighing machine, which obviates the common objection in regard to impositions by the machine-keepers?—I am; Mr. Salmon, of Woburn, many years ago, contrived, and had a patent (which has expired) for a weighing machine, intended to prevent

impositions on the carters: the machine being so contrived as to be locked up from the machine-keeper, and accessible only to the surveyor, and so as to exhibit the exact weight by a revolving index, like the hands of a clock, which are called clock-face indexes a great number of these weighing machines have long been in use in the kingdom, some in the immediate environs of London: by looking at the index of which machine, the carter, or any passer by, may see that the machine, before the carriage is drawn upon its weigh-bridge, is in just balance; and all the time the carriage remains upon the weigh-bridge, the index exhibits the weight, so that the carter can take it down; and at the same time the dial-plate is made an abstract of the law, by there being written against each of the weights fixed, the breadth of the carriage-wheel, and the season to which that weight is applicable at the commencement of penalties for over-weights.

Can you inform the Committee of the expense of a machine of this description?—I cannot; but it is trifling, compared with its advantages, and an index may be added to a machine upon the common principle, using weights, placed in a scale; they may be applied to any good machine already in use.

Are you of opinion there exists any necessity for limiting the number of horses in carts and waggons, upon roads where there are weighing-machines?—I am of opinion not; and even doubt the propriety of calculating the gate-toll by the number of horses which draw the carriage. Upon private or parish roads, where no machines are erected, there seems, however, no other mode of regulating or preventing excessive loads being carried, to the ruin of the roads, than limiting the number of horses; but in case of the practice becoming general, which already prevails in many of the towns in the middle of England, of there being a weighing-

machine, kept by a cottager, at all the principal entrances of the town, at which he is authorized (by the local magistrates, I believe,) to collect a small toll for each weighing, for those who voluntarily apply to him, by which means all loads passing into and out of such towns, may be, and the greater part of them are now, weighed; and if this were adopted in the environs of London, (with the addition of a yard and a warehouse, where a carter who has inadvertently taken up too large a load, either of dung, furniture, or other articles, of the weights of which he could not be accurately informed, may learn the same; and where, upon the result of this weighing, if it should be discovered that he had much too large a load, he could there throw off and deposit a part of it, either to abandon it if of small value like dung, or to take it up from the warehouse, at a future time,) these entrance weighing-machines would remove the only valid objection to weighing the loads of manure going out of London, by which the roads are at present more cut up and destroyed, than by any other description of carriages.

Will you have the goodness to state the principle upon which you prefer that the tolls should be regulated entirely by weights and breadth of wheels, without regard to the number of horses drawing?—Because nothing can be more vague or unsatisfactory, than the latter mode of defining weights, or preventing the carrying of excessive loads, because horses are of such very different degrees of size, condition and strength, and the humanity or otherwise of their drivers are so very different; but more on account of the very great inequality of the different roads of the kingdom, which this general regulation is now made to apply to, as to the number and steepness of the hills: the precautions that have been used, of setting up posts upon the tops and bottoms of those steeps, to define where extra horses may

be used, are entirely become useless, comparatively, none of the hills now remain, to any length, with so great a degree of steepness, as to cause it to be worth any one's while to keep horses stationed there, for the purpose of assisting heavy carriages up those hills for hire; still less has it occurred that any waggoner has spare horses following his waggon, for which he must pay tolls, in order to avail himself of this useless permission, to use any number of horses up the steep hills.

Are you of opinion that stage-coaches require, or would admit of any regulation with respect to their wheels or weights?—I am clearly of opinion, that they would not; for in travelling, when it has happened that I could not get a seat on the front of the coach, I have, through many long days, carefully attended to the impression made by the wheels of the carriages upon which I have been travelling (when they have been among the heaviest loaded coaches) and have compared these impressions with those of the carts and waggons, particularly broad-wheeled ones, which we met; from which observations, and other more particular ones, I am of opinion, that the injury done to the roads by the coaches, compared with their utility and the tolls they pay, is not such as to justify any legal restraint on their wheels or weights.

Are you of opinion, that it would be attended with any advantage to the roads, to encourage, by any regulation or exemption from tolls, the use of carriages, varying the length of their axles, so as to prevent their running in the same tracks?—I am of opinion it would be very beneficial, and have particularly so stated to the Board of Agriculture, with an example of the tolls over a new road, which are so regulated in Derbyshire: in addition to which, some inducement in the abatement of tolls, might be made to those carriages,

which now generally use single shafts, like the farmers' carts and waggons, on their adopting double shafts, so that all their horses may draw in pairs; this being applicable even to three-horse carts, as far as concerns the two foremost. Stage-coaches, for the reasons here alluded to, as they do all draw in pairs, and very seldom follow in any previous and deep rut, do far less damage to the roads than otherwise would happen; their springs also, and swiftness of motion, contributing, very materially, to lessening their wear of the road.

Are you of opinion that any advantage would be derived from the general commutation of statute duty?—I have long been of opinion that the whole principle of statute duty, as now regulated, is erroneous; labour in kind should entirely cease: and the surveyor collect a more equable rate on all property in his township; the present regulations for calling out the teams and making of a road-rate, are so complicated, as to be above the capacity of the majority of parish surveyors, who in most or all instances collect the rates for the turnpike roads as well as the private roads.

Will you state your opinion of the statute labour, as it particularly applies to turnpike roads?—In all the local road acts which I have examined, one half of the statute duty of each township is apportioned to each toll road which passes through any part or corner of that township, which in innumerable instances, is very highly prejudicial; a due proportion of the fair road rate, as already mentioned, should be payable to each toll road, where there are more than one in the township, in proportion (or nearly so, as the quarter sessions might order) to all the lengths of all the roads within the township which it contributes to repair.

From your observation of the different roads throughout the kingdom, do you think that important advantages would

be derived from their being placed under skilful surveyors, acting for large districts?—At present, the separate trusts are so exceedingly different in extent, many of them extending only three, four and five miles, while others have fifty or a hundred miles of road under their trusts, that it seems impracticable, in many trusts, to employ a very skilful and competent surveyor, on account of the great and unnecessary expense that would be incurred on the short lengths of road; but if the legislature should see it right to enact the appointment of thoroughly competent district surveyors, who might have the superintendence and control, to a defined extent, over the officers of the local trustees of turnpike roads, as well as over the surveyors of the parish roads within their districts, the most important advantages would result.

Do you not think great inconvenience arises from the great numbers generally found forming commissioners of turnpike trusts?—From my own experience, I cannot say that I have seen any evil from the great number of trustees, on the contrary, the greatest mis-management that I have seen in any roads, has arisen from the clergymen of the districts being almost the only acting trustees; the greatest and most active land owners frequently having no share in such trusts: the late duke of Bedford, for instance, not being a trustee in the vicinity of Woburn for many years after he took an active part in improving the district.

James Walker, Esq. called in; and Examined.

YOU are a civil engineer?—I am.

In the course of your experience have you turned your attention to the making and repairing of roads?—I have been employed in the making and repairing of several roads, and the regulation of others.

In what part of the kingdom have you been employed, and what observations have occurred to you upon this subject?—The whole of the works executed under the Commercial Road, the East India Road, the Barking Road, and the Tilbury Road Acts, have been under my direction, as well as the roads made under the Bridge and Dock Companies, for which I have been engineer. The Commercial Road, which is between the West India Docks and London is referred to in the report of a former Committee on highways, as particularly well fitted for heavy traffic; that road is seventy feet wide, and is divided into two footways, each ten feet, and a carriage road fifty feet wide, of which twenty feet in the middle is paved with granite. I have a section of the form of this road (No. 1, in the annexed plan.) The East India Dock branch of the Commercial Road is also seventy feet wide, ten feet of which is paved with granite. I have prepared also a section of that road (No. 2, in the plan.) The traffic upon the Commercial Road, both up and down, is very great, and necessarily required a width of paving sufficient for two carriages to pass upon it. I am quite sure that the expense of this road would have been very much greater, probably much more than doubled if it had not been paved, and that the carriage of goods would also have been much more expensive; indeed it would have been next to impossible to have carried the present loads upon a gravelled road. The road has been paved for about sixteen years, and the expense of supporting it has been small, although the stage-coaches generally, as well as almost all the carts and waggons, go upon it; while the expense of the gravelled part has been comparatively great. During the thirteen years that the East India Dock branch has been paved, the paving has not cost 20*l.* in repairs, although the waggons, each

weighing about five tons, with the whole of the East India produce, which is brought from the docks by land, have passed all that time in one track upon it, and a great deal of heavy country traffic for the last eight years, when a communication was formed with the county of Essex. The advantage of paving part of a road where the traffic is great, and the materials of making roads bad or expensive, is not confined to improving the conveyance for heavy goods and reducing the horses' labour; but as the paving is always preferred for heavy carriages, the sides of a road are left for light carriages, and are kept in much better repair than otherwise they could possibly be. It is not, I am sure, overstating the advantage of the paving, but rather otherwise, to say, that taking the year through, two horses will do more work, with the same labour to themselves, upon a paved road than three upon a good gravelled road, if the traffic upon the gravelled road is at all considerable, and if the effect of this, in point of expense, is brought into figures, the saving of the expense of carriage will be found to be very great when compared with the cost of the paving. If the annual tonnage upon the Commercial Road is taken at 250,000 tons, and at the rate of only 3*s.* per ton from the Docks, it could not upon a gravelled road be done under 4*s.* 6*d.* say however 4*s.* or 1*s.* per ton difference, making a saving of 12,500*l.*, or nearly the whole expense of the paving in one year. I think I am under the mark in all these figures, and I am convinced therefore that the introduction of paving would, in many cases, be productive of great advantage, by improving the gravel road, reducing the expense of repairs, and causing a saving of horses' labour much beyond what there is, I believe, any idea of. The expense of a ton of Aberdeen granite paving-stones laid in London, or in any similar situation, including laying, and every expense, is about 25*s.*; the cost of the same weight of

gravel is from 3*s*. 6*d*. to 5*s*. The cost of granite paving, 9 inches deep, is from 8*s*. 6*d*. to 10*s*. 6*d*. per superficial yard, or from 750*l*. to 920*l*. per mile for every yard in width. Guernsey granite is harder and more durable than Aberdeen granite, but is more expensive by about 10 per cent. and I think is this much better. Some stone of very good quality from near Greenock, has been used lately upon the Commercial Road, it is cheaper than Aberdeen, and appears to be very durable. The requisites for forming a good paving are to have the stones properly squared and shaped, not as wedges, but nearly as rectangular prisms; to sort them into classes according to their sizes, so as to prevent unequal sinking, which is always the effect of stones, or rows of stones, of unequal sizes being mixed together; to have a foundation properly consolidated before the road is begun to be paved, and to have the stones laid with a close joint, the courses being kept at right angles from the direction of the sides, and in perfectly straight lines, the joints carefully broken, that is, so that the joint between two stones in any one course shall not be in a line with, or opposite to a joint in any of the two courses adjoining. After the stones are laid they are to be well rammed, and such of the stones as appear to ram loose, should be taken out and replaced by others; after this the joints are to be filled with fine gravel, and if it can be done conveniently, the stability of the work will be increased by well watering at night the part that has been done during the day, and ramming it over again next morning. The surface of the pavement is then to be covered with an inch or so of fine gravel, that the joints may be always kept full, and that the wheels may not come in contact with the stones while they are at all loose in their places. Attention to these points will very much increase both the smoothness and durability of the paving. I have found great advantage from filling up, or, as it is

called, grouting the joints with lime-water, which finds its way into the gravel between and under the stones, and forms the whole into a solid concreted mass. The purpose served by the lime might also be effectually answered by mixing a little of the borings or chippings of iron, or small scraps of iron hoop, with the gravel used in filling up the joints of the paving. The water would very soon create an oxide of iron, and form the gravel into a species of rock. I have seen a piece of rusty hoop taken from under water, to which the gravel had so connected itself, for four or five inches round the hoop, as not to be separated without a small blow of a hammer. And the cast-iron pipes which are laid in moist gravel soon exhibit the same tendency.

It has occurred to me, as I stated to the chairman of this honourable Committee some weeks since, that considerable improvement would be found from paving the sides of a road, upon which the heavy traffic is great, in both directions, and leaving the middle for light carriages, the carmen walking upon the footpaths or sides of the road, would then be close to their horses, without interrupting, or being in danger of accidents from light carriages, which is the case when they are driving upon the middle of the road; and the unpaved part being in the middle or highest part of the road, would be more easily kept in good repair. I have prepared a section of a road formed in this way (No. 3 in the plan), but unless the heavy traffic in both directions is great, one width (say ten or twelve feet, if very well paved,) will be found sufficient; and in this case, I think the paving ought to be in the middle of the road. The width of many of the present roads is, besides, such, that ten or twelve feet can be spared for paving, while twice that width would leave too little for the gravelled part. Although the first cost of paving is so great, I do not think that any other plan can

be adopted so good and so cheap in those places where the materials got in the neighbourhood are not sufficient for supporting the roads. A coating of whinstone is, for instance, more durable than the gravel with which the roads round London are made and repaired; but much less so than paving; although the freight and carriage of the whinstone, and of the paving-stones, which form the principal items of the expense, are nearly the same. Scotch whinstone, or the granite rubble (that is, rough chippings of granite,) could not, I should think, be delivered into barges in the river, at less than from 14*s.* to 15*s.* per ton, the freight alone being from 11*s.* to 12*s.*, while the price of Aberdeen granite, in the same situation, is only from 19*s.* to 21*s.* and 22*s.* Maidstone ragstone in the rubble state, costs about 7*s.* per ton: it is a limestone, and much less durable than the whin. The carriage from the river to the road, of all these, is of course the same. Flint, again, is so much less durable than whin, that it will not bear the expense of carriage (which may be taken at from 1*s.* 6*d.* to 2*s.* per ton per mile) from any distance, to make it preferable to the gravel, or paving, in point of cost, for the roads near London. A double iron rail-road, to suit the London waggons, which some have recommended, would cost about 4,500*l.* per mile, and would be fitted for waggons only of one precise width, and for waggons or heavy carts only; while, from the difficulty of crossing it, it would form rather an obstacle to light carriages. Blocks of Aberdeen granite, twelve inches wide and fifteen inches deep, laid in the way of the wheels (as recommended by others,) would be nearly as expensive; and the eight joints, which would be formed between the stone and the gravel, by four rows of stone, would be found extremely troublesome and inconvenient. Both these substitutes for paving, therefore,

though equally expensive as paving, have peculiar disadvantages; and they have this besides, which is common to them both, that they make no provision for preventing the great wear upon gravelled roads, which is caused by the horses' feet, particularly if (as is the case in a rail-road) they are confined in one track.

Attention in the forming and repairing of roads, will in all cases do much to compensate for the inferiority of the material used for that purpose, of which the improvements in the general state of the highways within the last twenty years affords the best proof. To form the road upon a good foundation, and to keep the surface clear of water after it is formed, are the two most essential points towards having the best roads possible, upon a given country, and with given materials. For obtaining the first of these objects, it is essential that the line for the road be taken so that the foundation can be kept dry either by avoiding low ground by raising the surface of the road above the level of the ground on each side of it, or by drawing off the water by means of side drains. The other object, viz. that of clearing the road of water, is best secured by selecting a course for the road which is not horizontally level, so that the surface of the road may in its longitudinal section, form in some degree an inclined plane; and when this cannot be obtained, owing to the extreme flatness of the country, an artificial inclination may generally be made. When a road is so formed, every wheel-track that is made, being in the line of the inclination, becomes a channel for carrying off the water, much more effectually than can be done by a curvature in the cross section or rise in the middle of the road, without the danger, or other disadvantages which necessarily attend the rounding a road much in the middle. I consider a fall of about one inch and a half in ten feet, to be a minimum in this

case, if it is attainable without a great deal of extra expense. It is in the knowledge of the above points, and of the application of them in practice, that what may be called the science of road-making consists, as the observations apply in every case. When a road is to be formed, accurate sections of the rises and falls of the ground should always be taken, in the same way as is done for a canal, before the line is determined, or the levels of the road fixed upon, and when the course and levels of the road are laid down, the detail of the work ought to be particularly explained by a specification and plan, describing the manner in which each particular length is to be formed and completed.

The quantity of materials necessary to form the road depends so much upon the soil and the nature of the materials themselves, that it is impossible to lay down any general rules for them. The thickness ought to be such that the greatest weight will not affect more than the surface of the shell, and it is for this purpose chiefly, that thickness is required, in order to spread the weight which comes upon a small part only of the road over a large portion of the foundation. When the ground is very soft, trees, bavins or bushes, are applied to answer the same purpose, and to carry off the water previous to the materials of the road being so consolidated as to form a solid body, and to be impervious to water. Bushes are, however, not advisable to be used, unless they are so low as always to be completely moist. When they are dry and excluded from the air they decay in a very few years, and produce a sinking in place of preserving the road; a thickness of chalk is useful for the same purpose in cases where bushes are improper, the chalk mixing with the gravel or stones becomes concreted, and presents a larger surface to the pressure. If the material for making the roads is gravel, the common way is to lay it as it comes from

the pit, excepting the upper foot, or 18 inches or so, which is screened; but if whin or other stone is to be used, the size of the pieces into which it is broken should decrease as we approach the surface, the superficial coating not exceeding a cube from 1 inch to 1¼ inch. If the foundation is bad, breaking the bottom stone into small pieces is expensive and injurious, upon the principle I have above described, and also for the same reason that an arch formed of whole bricks or of deep stones is to be preferred to one of the same materials broken into smaller pieces, for in some counties the materials will admit of the foundation of the road being considered as of the nature of a flat arch, as well as of being supported by the strata directly under it: but the error in laying the stone in large pieces upon the surface is more common and more injurious. In all cases, whether the material is gravel or hard stone, the interstices between the pieces should be filled up solid with smaller pieces, and the finishing made by a thin covering of very small pieces, or road-sand or rubbish, for those interstices must be filled up before the road becomes solid, either in this way or by a portion of the materials of the road being ground down, which last mode occasions a waste of the material, and keeps the road unnecessarily heavy and loose. This observation applies to the repairing as well as the original making of roads, and the effect of this covering, or as it is called in the country, binding the loose stones, is so evident, that I have often wondered to see so little attention paid to it. If the material is soft, as some lime-stone, this is less necessary, and the quantity ought never to be more than is just sufficient for the purpose I have described. In the original making or effectually repairing of a road, it is, I think, best that the whole of the proposed thickness be laid on at once, for the sake of the road as well as of the tra-

veller; the materials of the road then form a more solid compact mass than when they are laid in thin strata, at different times, for the same reason that a deep arch of uniform materials is preferable to a number of separate rings. Though I state that an inclination in the longitudinal section of the road is always desirable for the purpose of clearing it of water, I am not of the opinion of those who recommend the road to be made and kept flat or level in its gross section. The variety of opinions and practice upon this point are very great; both extremes appear to me to be bad. A road much rounded is dangerous, particularly if the cross section approaches towards the segment of a circle, the slope in the case not being uniform, but increasing rapidly from the nature of the curve, as we depart from the middle or vertical line. The over rounding of roads is also injurious to them, by either confining the heavy carriages to one track in the crown of the road, or if they go upon the sides, by the great wear they produce, from their constant tendency to move down the inclined plane, owing to the angle which the surface of the road and the line of gravity of the load form with each other, and as this tendency is perpendicular to the line of draught, the labour of the horse and the wear of the carriage wheels, are both much increased by it.

It is not altogether foreign to the subject to notice here, the error of forming the inclination of the road-way upon bridges, in the direction of their length, or across the river, from a section of a curve for the whole length, rather than from two lines joined together by a curve, as I have recommended for the cross section of a road. It is to this cause that the very heavy pull is owing, which must have been noticed in just getting upon a bridge, which decreases as we advance towards the middle of the bridge, and which

would not have been so much felt, had it been spread regularly over the whole length (see No. 5, in the plan.)

The disadvantages of a flat road again are, that even if it is supposed to continue so, it is bad in principle, by doing away the tendency which a road ought to have, in every direction, to clear itself of water; but as the greatest wear will always be in the middle of the road, a level or flat road will very soon be concave; the middle of the road then becomes the watercourse, and the consequence, if the road is upon level ground, is, that the water and mud lie upon it, and injure the foundation and materials; or, if otherwise, that the stones or materials of the road are washed bare, and liable to be loosened and thrown up by the wheels coming into contact with their exposed angular surfaces. Many of the roads in the country afford examples of this, particularly after heavy rains, and if the country is at all hilly.

The best form for a road, in order to avoid those evils, is,—in my opinion, to form it, and to keep it with just a sufficient rise towards the middle, to incline the water towards the sides; and in place of making the whole width the section of one curve, to form it by two straight lines, forming inclined planes, and joined by a curve towards the middle. I have prepared a section of a road in the manner I have described (No. 4.) and as the lines, excepting at the centre, are straight, the section may be made to suit almost any greater or less width, by merely extending them. The section is taken nearly from a part of a road made under my direction in the country. The dotted line drawn upon it shows the form I alluded to when speaking of the circular road that ought to be avoided. I have seen ridges formed in what I thought well formed land, much after what I would recommend for the form of a road. The object of

forming the land into ridges, raised a little in the middle, is the same as that of raising the middle of a road to prevent the water from settling upon it, and what is sufficient for the ploughed land is certainly enough for a road. If the road is of good stone, four to five inches rise in ten feet is sufficient, gravel, and other inferior material, will allow a little more. In this section it may be worth while to notice the situation of the hedge and ditch, or rill on each side of the road, a more common, but I think a more dangerous and worse way, is to form the ditch close to the road, and to plant the quick upon a raised bank beyond it. I have dotted this mode also upon the section. The advantage of having the hedge next the road, consists in its greater safety to the traveller, particularly if a ditch of any considerable depth is necessary, and in the hedge being supported in its growth from the ground under the road, without drawing upon the farmer's side of the ditch; and it is I believe, this last advantage, which has led the author of an article in the Edinburgh Farmer's Magazine, with whom I am acquainted, to make nearly the same observations. In a length of road, made eight or ten years since. over a marsh, partly a bog, considerably under high water, where, from the level of the ground, and of the drainage, the ditches were obliged to be deep and wide, and therefore dangerous; I ordered some cuttings of willow to be stuck into the road-side of the ditch. In about two years they formed a blind to the ditch, and are now so thick and strong as to be a complete security from all danger. I may here take the liberty to say, that nothing is more injurious to roads than the permitting high hedges and plantations near them, their effect in keeping the rain suspended and dripping upon the road longer than otherwise it would, and in preventing the air and sun from drying the roads, is most destructive and

very general: and as the commissioners or principal men of the district are often the greatest offenders in this respect, the evil is one in which both the enactments and the application of them require the strictest attention and impartiality. After a road is properly made, the comfort of the traveller and the principle of economy on the part of the road-trust, both demand that it be not allowed to get much out of repair; the adage of "a stitch in time," applies particularly to the repairing of roads, and though not universally practised, is so well known, that it is, I presume, unnecessary to state reasons, for what no one acquainted with the subject at all doubts. The best season for repairing roads is, I think, the spring or very early in the summer, when the weather is likely neither to be very wet nor dry, for both of these extremes prevent the materials from consolidating, and therefore cause a waste of them, and at the same time, either a heavy or a dusty road; but if done at the time I have recommended, the roads are left in good state for the summer, and become consolidated and hard to resist the work of the ensuing winter.

When I remarked the great improvement in many of the highways during the last twenty years, I by no means meant to say that they are not still capable of much greater, or that many of them have not been much neglected. In many districts this is notoriously the case, and when the materials are the best, the roads are frequently the worst. There is no road round London upon which there is more heavy country traffic, than the first stage of the great Essex or Mile End road; and owing to the well directed attention of the chairman of the commissioners, and of their surveyor, there are few better roads any where, excepting in very wet heavy weather. Indeed I do not think it possible to do much, if any thing, in improving the superintendance and

repair of that road, with the material at present in use; for the nature of which, as well as for the exclusion of air and sun by buildings, proper allowance ought to be made in judging of the state of the roads near London, and when this is done, and the great wear considered, we may find that in very many cases, there is but little cause to find fault, and much room for commendation. The traffic upon the Mile End road is however too much for a gravelled road, and the expense for repair for the first three miles is consequently very great. The same remarks as to conduct and attention, are merited by the commissioners of other districts, and their gratuitous services entitle them to the thanks of the public; while in some parts of the kingdom, including Scotland, where the material is the very best, the roads are often in the worst condition, and the most unpleasant to travel upon. The stone is put in large pieces upon the road, without any covering or mixture of smaller material, and is left to take the chance of being broke and formed into a solid, or of tumbling loose upon the road. When a track is once formed in this stone-heap, it is not to be expected that the horses will be easily made to move out of it; and unless the thoroughfare is considerable, the road in use consists sometimes for a long period, of the two deep wheel-tracks, which are always filled with water during the winter, and of the horse's path between them, the other parts being covered with a body of loose stones, and rendered absolutely useless. These observations apply to some lengths of the most frequented highways, but are more particularly applicable to the cross roads and the parish roads. I had the opportunity of seeing the roads in the West Highlands last autumn; they are formed with judgement, and kept in good repair.

When the highways in a county are under the manage-

ment of trustees, it is common to divide them, and to assign a particular length to the trustees who live near it, without employing any person in the capacity of a surveyor. When this is the case, the state of repair depends much upon the observation and attention of the trustee; and the change in the state of the road often marks out the change of superintendance. A relative of mine has given up a good deal of his time and attention to a part of the roads in Stirlingshire, of which he is one of the trustees: no professional man could, perhaps, do the business better; and the effect of this attention is very visible. Instances of the same kind are frequent, but it is not to be expected that trustees generally can both understand, and have so great a relish for serving the public, as that the detail of the repairs of roads, if imposed upon them, will be always executed with the attention they require.

The case of parish roads is still worse, where the inhabitants are, without much regard to their habits of life, obliged in their turns to serve the annual office of surveyor of the highways. If such persons mean to signalize themselves during their being in office, the first step is often to undo what their predecessor has done, or has not perfected; and the love of self and of friends determines them to make sure while they have it in their power, that some favoured roads or lanes are put into proper order. If the surveyor is, on the contrary, an unwilling officer, or if the attention to his own affairs prevents him giving his time to the duties of the office, he avoids the fine by accepting the charge, pays the bills and wages without much knowledge of their nature or accuracy, and one of the labourers becomes, in fact, the road-surveyor; but in every case of annual nominations there is this evil, that so soon as the surveyor has, by a year's apprenticeship, begun to know something of the

nature of the business, his place is filled by another, who comes in for the same time to take lessons at the expense of the parish. Thus, while many simple trades require, by law, an apprenticeship of seven years, before the person is thought qualified to practise with his own capital, the road-surveyor is supposed fit, the very hour he is named, for an office which requires at least as much understanding and experience as the average of trades, and in which he has the capital of all the parish to speculate with. For these reasons, I have always been convinced of the propriety of an intelligent accountable officer in each district, but I do not see to whom he can be responsible with so great propriety, or in other words, in whom the chief control can be so well vested, as in the gentlemen who live in the county, who are almost daily witnesses of what is doing, and are chiefly interested in keeping down the expenses, at the same time having their roads in good repair.

Whether a board of roads, appointed by parliament, meeting once every year, and forming a report of the expense and state of the roads in each county, to be presented to parliament, with such observations as present themselves, as to improvements, or otherwise, taken from general surveys made by persons appointed by them, would be useful, by exciting a spirit of emulation and attention on the part of the different trusts, every member of this honourable Committee is as able, and perhaps more able, to give a disinterested judgment than I am; for I conclude, that if surveys are to be made, engineers will think they have some chance of being selected as the most proper persons to be employed on the occasion, under the board. The state of the roads continue to improve throughout the kingdom. Every friend to his country will be pleased, if the march of this improvement can be accelerated by a moderate reform, and carried into

remote corners and parishes, where it appears most to be wanted; but I much question the propriety of such a revolution as would lessen the interest, which, in their present situation, the commissioners ought to feel in the repair of their roads, and the consequence which the appointment tends to give them.

If country road-surveyors are appointed throughout the kingdom, the nomination might be with the commissioners of the county, and if friendship or local interest is supposed to operate too far, the nomination, or the examination previous to election, or the *veto* after it, might be with the central or other board, the members of which might be supposed not to be connected with the individual, in the same way as pilots and the masters of men of war are examined by the elder brethren of the Trinity House. And sub-surveyors or surveyors of parishes, might in the same manner be appointed, or undergo an examination by the county commissioners and county surveyor, to qualify them to be elected; for it is to be lamented, that in cases where parishes have, from the reasons I have mentioned, made the office of road-surveyors permanent, with a salary: the election being popular, has fallen, not upon the candidate who was really the best qualified, but probably upon some honest decayed tradesman, who, having proved himself unable to manage his own business, which he ought to have known the best, has thereby, and by his long residence, qualified himself for managing a public business, of which he probably knows nothing, but whether he does, or does not, rarely enters into the consideration of the majority of the voters.

IN what manner do you think the extra toll for overweight ought to be regulated; whether by the weight, or by the number of horses used, without regard to the weight? —I think by the weight most certainly; unless the object is

to discourage the breed of small horses, and encourage the over-loading and straining, of horses of all sizes. The number of horses is a very imperfect measure, or rather no measure at all of the injury done to the roads; for a load of three tons, drawn by one horse, injures the road as much, to say the least of it, as if two horses were used. It is not out of place to mention the extreme disproportion between the penalties for overweight, and the injuries which they are meant to compensate for, or to prevent; particularly when this over-loading is the effect of ignorance, which is almost always the case. When the tolls are in the hands of trustees, the penalty is almost always reduced; a proof that that fixed by law is exorbitant; but when the tolls are farmed, and the trustees do not reserve the power of mitigating the penalty, the poor carman has less chance of being saved perhaps from ruin.

Jovis, 1° *die Aprilis*, 1819.

Mr. *James Dean*, called in; and Examined.

WHAT is your profession?—I am a land agent and civil engineer, and am occasionally employed to solicit bills in parliament as an agent.

Where do you reside?—I reside in London about half the year, and the other half in Devonshire.

As an engineer, have you had the means of becoming acquainted with the roads of the kingdom?—About twenty years since, I had the appointment of surveyor to the trustees of the turnpike roads from Oxford to Henley upon Thames, and from Dorchester to Abingdon, in Berkshire; since then I have been employed about several roads in Devonshire and Cornwall, and, latterly, in surveying and

reporting on an extensive district of the roads in Somersetshire.

From the observations which you have made in this employment, are you able to give the Committee any information as to the best mode of improving the roads of the kingdom generally?—The first and most obvious improvement is to shorten distances; but even that must be governed by circumstances often of a local nature; a sound foundation, and the contiguity of good stone or gravel to a road, should not be overlooked in choosing a new line, or departing from an old one. In forming a new line in a level country, the transverse section should approach as near as possible to the form of the accompanying sketch No. 1, and in a hilly country to that of No. 2; in the former, the water from one half the road would be carried into a ditch on the field-side, and that of the other half into a ditch between the footpath and hedge-bank. When it is necessary to form a road on the side of a hill, the ditch should be on the higher side of the road, where it will receive the water falling from the high ground, and so keep the foundation of the road dry. I have figured the breadths of a good average turnpike road on sketch No. 1, but the breadth will frequently depend upon circumstances of a local nature. Near to great towns, it would be highly advantageous if the centre of the road, for about twelve feet in width, were to be paved with hard well-squared stones, nine inches deep, and the sides made with hard rubble stones or gravel. I need scarcely mention, that in applying the materials to a new line of road, the stones should be broken into pieces of an uniform size, as near as may be; that the larger should be laid of nearly an equal depth over the whole surface of the road, and the smaller, mixed with gravel, should be placed upon them. The repairing of roads should be conducted in the same manner as far as it is practicable; but, after all,

the only sure way of getting good roads is, for the trustees to employ men of education and science as their surveyors. In a few instances, where this has been done, the best consequences have resulted, and in no case is it more conspicuous than in the neighbourhood of Bristol, where Mr. M'Adam is the surveyor.

Will not a consequent impediment arise to the employment of men of education and of superior ability as surveyors, from the smallness of the funds upon small trusts or districts?—For that reason, I would recommend the consolidation of the several trusts, in each county, into one general trust, under the authority of one general act of parliament, leaving the adoption, however, of the acts to the discretion of the several trusts respectively in each county, making it compulsory only on the minority, at the expiration of a time to be limited, when a majority in amount of toll shall call for its adoption, and after insertion in the provincial papers and London Gazette.

Supposing parliament to adopt your suggestion as to the passing of such an act, and supposing that afterwards the trusts of none of the counties should adopt it as a general trust, would there be any objection to the act being so framed as to admit of adoption by such of the trusts as might prefer it to incurring the expense of a renewal of their then local acts?—I do not think there would be any well founded objection to an act made capable of being so applied; and I am of opinion, that the making it optional on trustees to adopt it or not, would render the measure extremely popular, and in the end be highly beneficial to the country.

Have you not lately prepared a bill for the trustees of an extensive trust in Somersetshire, including in it nearly all the improvements which you would recommend to be introduced into a general turnpike act?—I have prepared such a

bill; and it was intended that the same should have been brought before parliament in the present session, but the clerk to the trustees having omitted to put the notice required by the standing orders of parliament upon the sessions-house door, at the Michaelmas sessions, the trustees resolved to defer presenting their petition until the next session.

In what respect does the bill which you have prepared differ from the generality of local turnpike acts?—Many of the clauses of the bill are not so remarkable for originality, as their combination is calculated to produce extensive benefit to the country, by conferring larger powers than have heretofore been given to any one body of trustees; among others, it empowers the trustees to appoint committees, and make bye-laws; it binds them to provide a fund for buying up outstanding securities, and to pay off the further sums proposed to be raised under the new act, within the term of the act; the tolls on wheel-carriages are made referrible to the breadth of the fellies, and description of wheel, and to the weight drawn, rather than to the number of horses, drawing, and are founded on a statement which I had the honour of delivering to a Committee of the House of Commons in 1809. The standing orders of parliament require that on or before the 30th of September next, preceding any application to parliament for any Turnpike Act, a plan &c. of the roads proposed to be made or altered, shall be deposited with the clerk of the peace. It often happens, that in the Committee alterations are made in the proposed line, when the plan deposited becomes mere waste paper; the seventy sixth clause of this bill provides for the depositing of a plan, &c. last determined upon, with the clerk of the peace, signed by the Speaker, and being an authentic document can be referred to with safety. The bill also provides for the making of commodious footpaths by the sides of the roads. And as the paving, cleansing, lighting,

watching, &c. of the liberty or borough of * * * * is placed in the trustees of the roads, the trustees are empowered to rate the inhabitants, and are also empowered to light the streets, &c. with gas, and to allow gas to be taken from their mains for the lighting of private dwellings, manufactories, &c.; so that in all probability the latter indulgence may pay the greater part, if not the whole, of the expense of lighting the public lamps. The ninety-third clause empowers the trustees to pave, light and watch any town, village or place through which the roads pass, upon application of two-thirds of the inhabitants, and is in my view extremely important.

Have you any further suggestions to offer to the Committee that would tend to the improvement of the roads, or the laws relating to them?—Upon the subject of turnpike roads, and of wheel-carriages generally, I am of opinion that such a spirit of improvement has gone forth as, with the assistance of judicious legislative enactments, will in a few years carry both to a state of very great perfection; but I cannot close these remarks without observing on the injurious effect which the large fees paid to the higher officers of both houses of parliament has upon the growing improvements of the country, by preventing a recurrence to parliament to remove obstacles which the prejudice of some will not, and the incapacity of others cannot permit. The periodical expenses of renewing turnpike acts is really enormous, when it is considered that between the fees of parliament on the one hand, and a two month's residence in London of the country solicitor, to manage the business, besides a parliamentary agent in town to assist him, four or five hundred pounds are soon swallowed up; but I also feel it right to suggest, that if parliament would allow affidavits to be made before two magistrates in the county, of the notices directed by the standing orders of parliament, having been duly

given, of plans and of books of reference being lodged with the clerk of the peace, and of the names of the persons assenting to, dissenting from, or being neuter in respect of any proposed new road, the solicitor need not remain in town more than three days, and the expenses, except in cases of opposition, need not exceed 200*l.*

Would you, as a parliamentary agent, undertake to prepare and conduct an ordinary road bill through parliament for 200*l.*, to include all expenses, where there is no opposition?—I would undertake any number at that sum, provided the proofs before mentioned were admitted to be made by affidavit in the county, in like manner as the proofs are now given to facilitate the passing of inclosure bills.

Jovis, 6° *die Maii*, 1819.

Thomas Telford, Esquire, called in; and Examined.

YOU are, I believe, a civil engineer?

Yes, I am.

The roads which have been formed by direction of the Parliamentary Commissioners for the Holyhead road, and under your management, having been described to this Committee as being very perfect, will you have the goodness to state your opinion as to the present condition of the different turnpike roads of the kingdom, and what improvements you would recommend in their direction and management. In the first place, state to the Committee in what respect you consider the roads of the kingdom at present to be defective, either in their formation or management?—

With regard to the roads in England and Wales, they are in general very defective, both as to their direction and inclinations, they are frequently carried over hills, which

might be avoided by passing along the adjacent valleys; at present the inclinations are inconveniently steep, and long continued. I might instance many principal lines, over which I have had frequent occasion to travel: I shall select the great road from Holyhead, through North Wales to Shrewsbury; and from thence by Birmingham and Coventry to London. On the Welsh portion of it, those parts which have been improved under the direction of the Parliamentary Commissioners for the Holyhead road, the inclinations were formerly (in many instances) as much as one in six, seven, eight, nine, and ten, the width at the same time frequently not exceeding twelve feet, without protection on the lower side, and the roadway itself of improper construction. The improvements which have lately been made in North Wales, I beg leave to submit as models for roads through hilly countries, although these improvements have been made through the most difficult and precipitous districts of that country, the longitudinal inclinations are in general less than one in thirty; in one instance, for a considerable distance, there was no avoiding one in twenty-two, and in another, for about two hundred yards, one in seventeen; but in these two cases, the surface of the roadway being made peculiarly smooth and hard, no inconvenience is experienced by wheeled carriages. On flat ground, the breadth of the roadway is thirty-two feet, where there is side cutting not exceeding three feet, the breadth is twenty-eight, and along any steep ground and precipices, it is twenty-two, all clear within the fences; the sides are protected by stone walls, breast and retaining walls and parapets; great pains have been bestowed on the cross drains, also the draining the ground, and likewise in constructing firm and substantial foundations for the metalled part of the roadway. From Shrewsbury upwards, the road at present is encumbered with many hills, all of which might be avoided,

or much improved. There is a very long one between Shrewsbury and Heygate, several between that point and Shiffnal, two between Shiffnal and Wolverhampton, one between Wolverhampton and Birmingham, viz. at Wednesbury, &c. Maiden Hill, between Birmingham and Coventry; Braunston Hill, between Dunchurch and Daventry; a continued succession of hills between Daventry and Towcester; afterwards the well-known Brickhill and Hockliffe hills, besides the very circuitous and imperfect road between South Mims and Barnet.

Another instance I would beg leave to mention to the Committee, is the road between the towns of Shrewsbury and Worcester, on the way to Bath, which consists of nearly a succession of very high and inconveniently steep hills, although very easy inclinations might be obtained by passing along the side of the river Severn.

I have mentioned these two instances as examples of the present imperfections of main roads, and it is quite evident they might all be readily avoided by lines of new road, easily to be accomplished. These, I presume, the Committee will admit are sufficient to show the present state of many other roads in the kingdom, they not having been selected as more particularly defective than others.

The shape, or cross sections and drainage of the roads, are quite as defective as the general direction and inclinations; there has been no attention paid to constructing a good and solid foundation for the roadway; the materials, whether of gravel or stones, have seldom been sufficiently selected and arranged; and they lie so promiscuously upon the road as to render it inconvenient to travel upon, and promote its speedy destruction. The shape of the road, or cross section of the surface, is frequently hollow in the middle; the sides encumbered with great banks of mud, which have accumulated sometimes to the height of six,

seven and eight feet; these prevent the water from falling into the side-drains; they also throw a considerable shade upon the road itself, and are gross and unpardonable nuisances. The materials, instead of being cleansed of the mud and soil with which they are mixed in their native state, are laid promiscuously upon the road; this, in the first instance, creates an unnecessary expense of carriage to the road, and afterwards nearly as much in removing it, besides inconvenience and obstruction to travelling; the materials should therefore be cleansed on the spot where they are procured, from every particle of earth, by screening, or if necessary, even by washing; some additional expense might in the first instance be incurred by these operations, but it would be found by much the most economical and advantageous mode in the end. In all cases, materials in their native state are composed of particles and pieces of different sizes, it is most important that those should be separated, and that the largest size should be reduced to not more than six or eight ounces in weight, and laid in the bottom part of the road; those that are under that weight or size may be laid on the top or surface of the road; the surface itself should be made with a very gentle curve in its cross section, just sufficient to permit the water to pass from the centre towards the sides of the road, the declivity may increase towards the sides, and the general section form a very flat ellipsis, so that the side, at the time, should (upon a road of about thirty feet in width) be nine inches below the surface in the middle. Connected with the cross section are the side drains which are to receive the water, and which drains, in every instance, I particularly recommend to be on the field-side of the fence, with apertures in that fence for the water to pass from the sides of the road into them.

The fences themselves on each side form a very material

and important subject, with regard to the perfection of roads; they should in no instance be more than five feet in height above the centre of the road, and all trees which stand within twenty yards from the centre of it ought to be removed. I am sure that twenty per cent. of the expense of improving and repairing roads is incurred by the improper state of the fences and trees along the sides of it, on the sunny side more particularly; this must be evident to any person who will notice the state of a road which is much shaded by high fences and trees, compared to the other parts of the road which are exposed to the sun and air. My observations, with regard to fences and trees, apply when the road is on the same level as the adjacent fields; but in many cases, on the most frequented roads of England, more stuff has been removed from time to time than was put on; the surface of the road is consequently sunk into a trough or channel from three to six feet below the surface of the fields on each side; here all attempts at drainage, or even common repairs, seem to be quite out of the question; and by much the most judicious and economical mode will be to remove the whole road into the field which is on the sunny side of it. In cases where a road is made upon ground where there are many springs, it is absolutely necessary to make a number of under and cross drains to collect the water and conduct it into the aforesaid side-drains, which I have recommended to be made on the field side of the fences.

In constructing the bottom part of a road, (which would, of course, be made of an elliptical form) if it is upon clay, or other elastic substance, which would retain water, I would recommend to cover the whole bottom of the road with vegetable soil, in cases where the natural shape of the ground admits; I would not remove the original surface, and where there are inequalities I would fill them up with vege-

table soil, so as to cut off all connexion with clay. Where gravel is the material to complete the road with, I have already mentioned, that it ought to be completely cleansed of every particle of clay or earthy substance, and its different sizes ought to be selected and arranged by means of riddling or washing; in the use of the riddle, the particles of earth or clay adhere so much to the stones that it frequently requires to be exposed to the sun, air, and frost, for several months, and then riddled over again. In this gravel, the stones are of different sizes and different shapes; all those that are round ought to be broken with a small hammer, and in mentioning hammers, I beg leave to draw the attention of the Committee to their weight, shape and manner of using, which is of much more importance than any one can conceive who has not had much experience in road-making; the difference in managing this operation being not less than ten per cent. and is, besides, of equal importance towards the perfection of the road; the size and weight of the hammer I would apportion to the size and weight of the stones, and the stones should be broken upon the heap, not on the ground; it must be evident that using round stones will be the means of deranging the position of those near them, and of grinding them to pieces.

Are you of opinion that the gravel which is found in the pits in the neighbourhood of London is calculated for making roads capable of bearing the heavy weights which the great traffic round London occasions to be used upon them?—I am of opinion that the materials in the whole valley or plain round London being entirely silecious, or flints, and easily ground to dust, are very improper. This must be evident to every person who travels near London in any direction.

Are you of opinion that it would be advisable or practicable

to procure from any particular part of the country, either by canal, or by river conveyance, better materials, so as to form perfect roads, without the necessity of paving them?—That those materials could be procured both by the canals; and by sea is evident; but I am satisfied that the most economical and preferable mode would be by means of paving.

Do you consider that it would be advisable to pave the whole of the roads, or that the paving of the centre or sides, as has been recommended by some witnesses, would be sufficient?—I apprehend that the paving a proper width in the centre would be quite sufficient, gravel might be proper enough for the sides, upon the same principle that we, in all new roads which are constructed, make use of metalling, or broken stones on the middle part of the road, for about from sixteen to eighteen or twenty feet in breadth, and leave the sides gravelled and kept dry; this, in general, forms a very perfect road.

Is there any principle which you would think proper to recommend in regard to the shape of the stones to be used in paving roads?—I am of opinion that the general shape of the stones at present used for paving, and the modes of distributing them are very imperfect, the lower part of the stones being of a triangular wedge-like shape, which, instead of enabling them to resist the weights which come upon them; easily penetrate into the substratum; the stones are also broken of an unequal size. The remedies for these defects are obvious, they should be as nearly as possible of a cubical form, its lower bed having an equal surface with its upper face; they should be selected as nearly as possible of an equal size, and they should never be of great length on the face.

In quarrying and preparing the stones would there be any

additional expense in forming them into the cubical shape now recommended? —There would certainly be an additional expense in the preparation, because there would be more work required in the dressing, and many stones must be rejected which are now used; but I think the additional expense would be very well bestowed.

Are you of opinion that great injury is done to turnpike roads by the heavy weights carried in waggons upon them?—I am.

Are you of opinion that any breadth of wheels for those waggons will justify the present exemption from tolls?—It certainly ought not.

In what manner would you recommend that the tolls should be apportioned to the weights carried by waggons on those roads?—I am of opinion that the most advisable mode would be to apportion the tolls to the weight carried on each wheel, without reference to the breadth, provided it is not allowed to be less than four inches.

For the purpose of assessing the tolls in this instance, would it not be necessary that the waggon should be weighed at every turnpike gate?—There ought to be a power to do it, but there might be a check by means of toll tickets, similar to what is done upon navigable canals.

With a view of establishing good roads generally throughout the kingdom, and of keeping them in repair upon the most economical plan, what limitation would you propose as to the actual weight each carriage should be allowed to carry?—I should think it should never exceed four tons, which should be a ton upon each wheel; when it exceeds that weight the best materials which can be procured for road-making must be deranged and ground to pieces.

Martis, 11° *die Maii*, 1819.

Mr. *Robert Perry*, called in; and Examined.

YOU hold a situation in the Post-office?—Yes, under Mr. Johnson, inspector of the mails in the Post-office.

Since the examination of Mr. Johnson before this Committee, has the Post-office received any further report on the state of any of the roads near the Metropolis?—Yes; one that is between Staines and Bagshot, which I have brought with me.

[*Delivered in, and read:*]

State of the Turnpike Road between Staines and Bagshot, May 4th, 1819.

From Staines Bridge to Egham the form of the road has been considerably altered for the better, with plenty of watercourses and arched drains: through Egham town the dirt has been entirely removed, and a very plentiful supply of well-sifted gravel laid on, which will in a short time make a good hard road. The hill likewise has recently been covered with a thick coat of good stones, which will require a little time to cement; from thence the road is greatly improved; the sides are pared down, and kept particularly clean.

At Virginia Water every thing appears to have been done to the hills, that the time and sandy nature of the soil would permit; it is now in a good form, and level.

From Virginia Water Hill, by Broom Hill Hut, the road has been well scraped, the watercourses opened, and the sides kept clean, and is in a very good state all the way to Bagshot.

(Signed) *Samuel Maddocks.*"

ABSTRACT OF RETURNS OF TURNPIKE TRUSTS ROUND LONDON.

NAME OF TRUST.	ACTS OF PARLIAMENT.	LENGTH OF ROAD.	AMOUNT OF TOLLS, 1818.	EXPENSES, 1818.	DEBT.
Surrey New Road - -	26, 47, & 58 Geo. 3 -	6 M. 440 Yds.	£. 9,210 — —	£. 9,210 — —	£. 9,000 — —
City Road - - -	43 Geo. 3. c. 68.	1 M. 440 Yds.	1,645 — —	1,661 6 4	1,623 12 6
St. Mary-le-Bone - -	7, 8, & 29 G. 3. 23 & 48 G. 3.	4 M. 1,584 Yds.	3,960 — —	3,808 16 10	3,500 — —
Kensington - - -	35 & 51 Geo. 3.	17 M.	14,660 Tolls.	12,983 18 8	11,500 — —
Cannon Street - - -	27 Geo. 2. 5 & 42 Geo. 3. -	1 M. 747 Yds.	1,167 — 6	962 9 2	3,519 18 6
New Cross - - -	24 May 1802, 27 May 1809.	39 M. 660 Yds.	11,833 8 3	11,660 11 8	2,464 16 —
Whitechapel - -	25 & 43 Geo. 3.	34 M. 220 Yds.	12,450 — —	13,086 2 1	2,300 — —
Surrey and Sussex -	42 & 58 Geo. 3.	57 M. 798 Yds.	14,606 10 —	14,758 18 7	3,750 — —
Highgate and Hampstead	41 Geo. 3. -	20 M.	11,536 — —	14,183 17 2	7,900 — —
Hackney - - -	54 Geo. 3. -	6 M. 880 Yds.	4,355 — —	3,942 — —	2,100 — —
Old Street - - -	55 Geo. 3. -	1 M. 880 Yds.	1,520 — —	1,255 — —	—
Stamford Hill - -	55 Geo. 3. -	20 M. 880 Yds.	10,540 — —	11,393 — —	15,000 — —
		210 M. 489 Yds.	£. 97,482 18 9	£. 98,856 — 6	£. 62,658 7 —
			£. 464. 4. p' Mile.	£. 470. 14. p' Mile.	£. 298. 7. p' Mile.

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